

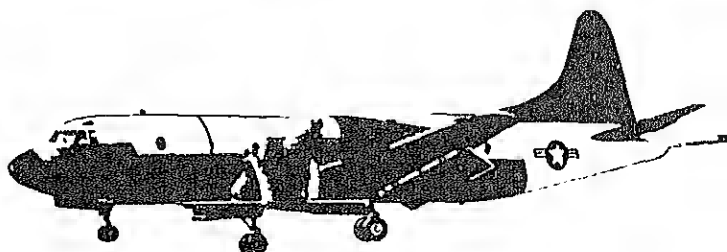
TRAINEE WORKBOOK

FOR

ANCED FIRST TERM AVIONICS CO

CLASS A1

C-100-2010



UNIT 9

TACAN

CNTT-M529 Rev. 6-81

PREPARED BY

**NAVAL AIR TECHNICAL TRAINING CENTER
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MILLINGTON, TENNESSEE**

PREPARED FOR

NAVAL TECHNICAL TRAINING COMMAND

C OBJECTIVES

DY ASSIGNMENT NO. T5.3.2, INTRODUCTION TO A SURFACE BEA
STATION.

TION SHEET NO. T5.3.3, TEST EQUIPMENT

EET NO. T5.3.3, INTRODUCTION TO A TACAN SYSTEM

DY ASSIGNMENT NO. T5.3.3, INTRODUCTION TO A TACAN UNIT

TION SHEET NO. T5.3.4, INTEGRATED CIRCUIT THEORY

DY ASSIGNMENT NO. T5.3.4, BLOCK DIAGRAM ANALYSIS

EET NO. T5.3.5, RANGE DECODER CIRCUIT ANALYSIS

DY ASSIGNMENT NO. T5.3.5, RANGE DECODER MODULE ANALYSIS

EET NO. T5.3.6, RANGE "A" MODULE ANALYSIS

DY ASSIGNMENT NO. T5.3.6, RANGE "A" MODULE ANALYSIS

EET NO. T5.3.7, RANGE "B" MODULE ANALYSIS

DY ASSIGNMENT NO. T5.3.7, RANGE "B" MODULE ANALYSIS

DY ASSIGNMENT NO. T5.3.9, ANTENNA SELECTOR MODULE ANALY

DY ASSIGNMENT NO. T5.3.10, POWER SUPPLY

EET NO. T5.3.11, BEARING DECODER MODULE ANALYSIS

DY ASSIGNMENT NO. T5.3.11, BEARING DECODER MODULE ANALY

EET NO. T5.3.12, BEARING "A" AND "B" MODULE ANALYSIS

DY ASSIGNMENT NO. T5.3.12, BEARING A AND B MODULE ANALY

DY ASSIGNMENT NO. T5.3.13, TACAN TROUBLESHOOTING

DY ASSIGNMENT NO. T5.3.14, RF MODULE ANALYSIS

DY ASSIGNMENT NO. T5.3.16, AIR-TO-AIR MODULE ANALYSIS

basics of modern rapid reading consist of five points. If you will soon read at a swift pace and still understand what you read:

PRE-READ: Before you start an article, note the headlines, figures and captions -- everything that will help you size up the material before you start. Then read the first two or three paragraphs and look over the opening sentences of the next several paragraphs. Note the conclusion of the article. Now you know enough to decide if you want to read it.

ADJUST YOUR SPEED: It's as silly to read everything at the same speed as it would be always to drive your car at 40 mph. From your own experience you can usually gauge the difficulty of the material. Here are some rules of thumb on reading speeds:

For information only: Go fast, but don't miss the point.

To evaluate ideas: Go slower, because you are asking questions.

For self-enrichment: Even slower, because you want to catch the full meaning.

READ IN PHRASES: Normally, you read with a series of quick glances, seeing words only when your eyes are stopped. You can increase your speed by increasing the number of words you see at each stop. Read in phrases instead of single words. You should read / this material in /
swift takes.

CONCENTRATE: If you don't, you will get nothing out of your reading. Speed. There are two tricks: First, give yourself a good environment -- good light, no glare; a comfortable but not too cozy chair; freedom from noise and other outside distraction. Second, get rid of distracting emotional problems. If you are worried, try to do something, even if it's no more than making a phone call or writing a letter. That way, you will clear your mind for action.

REMEMBER: The purpose of reading swiftly is to get more information. The hazard is reading without remembering. Here are some tips that will help you retain what you read:

Summarize as you go: At first, you can even write down a brief summary of the first two or three paragraphs; soon you will learn to do it mentally in your mind as you read.

Ask questions: As you read, you can anticipate what's coming next. This will help keep you focused on the target.

the radio range system.

State what information is provided by the tacan system provided by other air navigational systems presented in the program.

Match a given list of frequencies with the appropriate navigational aid.

List the two major units of a tacan system.

State the number of channels in a tacan system.

List the transmit and receive frequencies of the airborne transceiver and the surface transceiver.

List the two types of modulation and their major use in the system.

State the pulse width and pulse spacing of a standard pulse pair.

State the frequency, in Hz, of the identification code and the interval which it is transmitted from the surface transceiver.

State the prf of the tacan airborne transmitter in standard track conditions.

IFIC OBJECTIVES:

- State the type and electrical length of the antenna used tacan surface station.
- State the purpose of rotating one parasitic reflector and antenna at 900 rpm.
- State the purpose of rotating the directors around the antenna at 900 rpm.
- State the frequency of the main reference burst in cycles per second.
- State the number and spacing of pulse-pairs in the main reference burst.
- List the two components of the transmitted signal which are used to establish the approximate bearing.
- State the frequency of the auxiliary reference burst in cycles per second.
- State when the auxiliary reference burst is transmitted.
- List the number and spacing of the pulse pairs in the auxiliary reference burst.
- List the two components of the transmitted signal used to establish azimuth accuracy of plus or minus two-ninths ($2/9$) of a circle.
- State the purpose of the random or squitter pulse-pairs.
- State the pulse pair recurrence rate of the identification signal.
- State the spacing of the pulse pairs of the identification signal.
- State when a tacan surface station will transmit range information.
- State the total number of pulse-pairs per second (pps) transmitted by a tacan surface station.
- List, in proper sequence, the pulse groups transmitted by a tacan surface station.

SPECIFIC OBJECTIVES:

- . State the information a pilot receives from the tacan system.
- . State the purpose of the antenna reflector.
- . State the point, in reference to magnetic North, to which the reference burst is transmitted.
- . State the purpose of the antenna directors.
- . State the number of auxiliary reference bursts for one reflector revolution.
- . State the characteristic of a main reference burst.
- . State the characteristics of an auxiliary reference burst.
- . Describe the composite video waveform of one antenna burst transmitted by the ground station.
- . Describe a tacan pulse pair.
- . List the tacan modes of operation.
- . State the information and priority transmitted by the ground station.
- . State the tacan transceiver transmit and receive frequencies.
- . Demonstrate the ability to operate the test equipment used in a tacan system.
- . Demonstrate the ability to perform an operational check of a tacan system.
- . Recognize the signal transmitted by the simulator.
- . Record the layout of the modules on the chassis.
- . Determine tacan bearing by observing output waveform on a simulator.
- . Recognize the different types of signal contained in a tacan waveform.

for range and bearing information.

C. SPECIFIC OBJECTIVES:

1. State the general purpose of the
 - (a) R-F module
 - (b) Range decoder module
 - (c) Range A module
 - (d) Range B module
 - (e) Magnetic amplifier module
 - (f) Range mechanical module
 - (g) Bearing decoder module
 - (h) Bearing A module
 - (i) Bearing B module
 - (j) Bearing mechanical module
 - (k) Air-to-air module
 - (l) Antenna selector module
2. Analyze the ranging system simplified block diagram
3. Analyze the bearing subsystem simplified block diagram

LESSON NO. T5.2.5

A. TITLE: RANGE DECODER MODULE

B. PURPOSE: To provide an understanding of the theory of the range decoder module.

C. SPECIFIC OBJECTIVES:

1. State the purpose of the range decoder.
2. Name the five major sections of the range decoder module.
3. Describe the types of circuits used in the range decoder module.
4. Describe the inputs and outputs of the range decoder module.
5. State the purpose of the different sections.
6. State where the different outputs of the section are taken.

State the purpose of the range A module.

List the outputs from the range A module.

Analyze the operation of the range A module, using the program.

Describe the operation of the countdown multivibrator.

Describe the operation of the integrator control R-S flip-flop.

Describe the operation of the coarse range integrator.

Describe the operation of the 190 μ sec one shot multivibrator.

Describe the operation of the pulse former and fine range generator.

Describe the operation of the early gate former.

Describe the operation of the late gate former.

Describe the operation of the selector NAND gate.

Describe the operation of the reply pulse multivibrator.

Describe the operation of the coincidence circuits.

O. T5.3.7

E: RANGE B MODULE ANALYSIS

OBJECTIVE: To develop an understanding of the purpose and operation of a typical tacan range B module.

INSTRUCTIONAL OBJECTIVES:

State the purpose of the range B module.

Describe the operation of the control relays in late coincidence track mode.

Describe the operation of the control relays in search mode.

Describe the operation of the control relays in track mode.

Describe the operation of the control relays in memory.

Describe the transition from search to track.

Analyze the operation of the early and late coincidence circuits.

Analyze the operation of the magnetic amplifier control circuits.

Analyze the operation of the late coincidence track relay circuits.

Analyze the operation of the track relay control circuit.

Analyze the operation of the memory circuits.

O. T5.3.8

E: PROGRESS TEST AND REVIEW

OBJECTIVE: To determine your progress this week and need for instruction.

INSTRUCTIONAL OBJECTIVES:

Complete examination.

Participate in review.

CIFIC OBJECTIVES:

State the purpose of the antenna selector module.

Describe the two inputs that control the antenna selector.

Analyze the operation of the antenna selector module when no input is present.

Analyze the operation of the antenna selector module when the two inputs are present.

NO. T5.3.10

LE: TACAN POWER SUPPLIES

POSE: To develop an understanding of a typical tacan power supply.

CIFIC OBJECTIVES:

State the purpose of the

- 1A1A15 power supply module
- 1A1A9 power supply module
- 1A3 inverter

List the a-c outputs from the 1A1A15 module.

Describe the operation of the series regulator magnetic core (T802).

List the d-c outputs from the 1A1A15 module.

Describe the operation of the +120 vdc supply and regulator.

Describe the operation of the -108 vdc supply and regulator.

Describe the operation of the 90 second delay circuit.

List the outputs of the 1A1A9 module.

Describe the operation of the +28 vdc circuits.

Describe the operation of the +15 vdc supply and regulator.

Describe the operation of the -15 vdc supply and regulator.

NO. T5.3.11

LE: BEARING DECODER MODULE

POSE: To develop an understanding of the operation of the bearing decoder module, through block diagram and circuit analysis.

CIFIC OBJECTIVES:

State the purpose of the bearing decoder.

Describe the circuits used to detect the amplitude modulation.

Describe the circuits used to detect the North burst.

Describe the circuits used to detect the auxiliary reference burst.

Analyze the operation of the circuits used to detect the amplitude modulation.

Analyze the operation of the circuits used to detect the North burst.

Analyze the operation of the circuits used to detect the auxiliary reference burst.

7. Describe the operation of the 15 Hz phase comp
8. State the different modes of operation.
9. Describe the operation of the 15 Hz phase comp
10. State the conditions required to change from 1 track.
11. State the conditions required to change from 1 track.
12. Describe the TACH feedback used in search and

LESSON NO. T5.3.13

TITLE: TROUBLESHOOTING A TACAN UNIT

PURPOSE: To become proficient in the practical and shooting of a tacan.

SPECIFIC OBJECTIVES:

1. Observe safety precautions.
2. Troubleshoot the range circuits.
3. Troubleshoot the bearing circuits.

LESSON NO. T5.3.14

TITLE: R-F MODULE ANALYSIS

PURPOSE: To provide a better understanding of the circuitry used in the r-f module.

SPECIFIC OBJECTIVES:

1. State the purpose of the channel servo circuit
2. State the purpose of the frequency multipliers
3. State the purpose of the transmitter preselect
4. State the purpose of the I-F amplifiers.
5. State the purpose of the modulator.
6. Describe how tacan pulse pairs are generated.
7. Describe how A/A reply pulses are generated.
8. Describe the operation of the suppression circ
9. Describe the operation of the AGC circuits.
10. State the purpose of the A/A storage counter.
11. Describe the operation of the transmitter prot
12. State the purpose of the A/A priority circuits

system.

ECIFIC OBJECTIVES:

Complete performance test following procedure outline sheet.

Record required information on data sheet.

NO. T5.3.16

TITLE: AIR-TO-AIR MODULE ANALYSIS

PURPOSE: To develop a basic understanding of a typical air system.

ECIFIC OBJECTIVES:

State the purpose of the air-to-air module.

Analyze the received interrogation signal.

Describe the operation of the delay multivibrator.

Describe the operation of the reply pulse generator.

List the modules affected by air-to-air operation.

Describe the effects on these modules when operating to-air mode of operation.

NO. T5.3.17

TITLE: PHASE EXAMINATION

PURPOSE: To determine your progress in this unit and prepare of this phase.

ECIFIC OBJECTIVES:

To complete an objective-type examination for the purpose of determining understanding of the phase material.

Reading assignment: Introduction to a Tacan surface station
CNATT M205 PAT

Answer the following questions:

1. The surface beacon station operates at a constant approximately
 - a. 3600 pps.
 - b. 2700 pps.
 - c. 120 to 150 pps.
 - d. 22 to 30 pps.
2. The main reference burst is transmitted when the magnetic field is
 - a. magnetic east.
 - b. magnetic north.
 - c. true north.
 - d. true east.
3. The spacing between pulse pairs in the main reference burst is
 - a. 30 μ sec.
 - b. 12 μ sec.
 - c. 8 μ sec.
 - d. 24 μ sec.
4. The pulse pair spacing of the auxiliary reference burst is
 - a. 30 μ sec.
 - b. 12 μ sec.
 - c. 8 μ sec.
 - d. 24 μ sec.
5. How many pulse pairs are in the main reference burst?
 - a. 22 to 30.
 - b. 120 to 150.
 - c. 8.
 - d. 12.
6. The auxiliary reference burst is transmitted every 100 seconds after the main reference burst.
 - a. 40.
 - b. 90.
 - c. 50.
 - d. 270.

17.

The main reference burst is transmitted

- a. 900 per minute.
- b. 199 per minute.
- c. 120 to 150 per minute.
- d. 22 to 30 per second.

In the Tacan system, the identification signal is transmitted

- a. 75 μ sec.
- b. 37.5 μ sec.
- c. 40°.
- d. 562.5 revolutions of the antenna.

The spacing of the pulses in a pulse pair is

- a. 12 μ sec.
- b. 3 1/2 μ sec.
- c. 24 μ sec.
- d. .00012 msec.

The pulse width of a pulse in a pulse pair is

- a. 3 1/2 μ sec @ 1/2 power points.
- b. 3 1/2 μ sec.
- c. 12 μ sec @ 1/2 power points.
- d. 12 μ sec.

Of the 3600 pps transmitted, how many are used for azimuth

- a. 2700.
- b. 180.
- c. 900.
- d. 195.

How many parasitic elements are used to produce the 135 bearing signal?

- a. 1.
- b. 8.
- c. 15.
- d. 9.

The surface beacon station uses what type of modulation?

- a. A-M and F-M.
- b. Pulse and r-f.
- c. Pulse and amplitude.
- d. Amplitude and r-f.

The surface beacon station can supply range information to many aircraft simultaneously?

- a. 195.
- b. 299.
- c. 3600.
- d. 100.

What is the frequency of the ID pulses transmitted by the station?

- a. 135 Hz.
- b. 1350 Hz.
- c. 2700 Hz.
- d. 3600 Hz.

E: TEST EQUIPMENT

Preliminary setup procedures

1. Oscilloscope (453/R453) - Turn the POWER switch ON.
2. Beacon Simulator (ARM-22A)
 - a. Ensure the antenna is connected from J-704 on sig to the antenna jack on the 8H7 trainer.
 - b. Turn the AC and DC POWER switches on the power supply ON.
 - c. Turn the AC switch on the signal generator to ON.
3. 8H7 Tacan Trainer
 - a. Ensure that no modules are missing.
 - b. Turn the POWER switch on the indicator panel to ON.

Operational procedure for Type 453/R453 oscilloscope

1. TURN-ON procedure
 - a. Cathode ray tube controls
 - (1) INTENSITY: fully CCW.
 - (2) FOCUS: midrange.
 - (3) SCALE: fully CCW.
 - b. Vertical controls (both A and B channels)
 - (1) VOLTS/DIV: 20 mv.
 - (2) VARIABLE: CAL.
 - (3) POSITION: midrange.
 - (4) INPUT COUPLING: DC.
 - (5) MODE: channel 1
 - (6) TRIGGER: NORM.
 - (7) INVERT: pushed in.
 - c. Triggering controls (both A and B channels)
 - (1) LEVEL: CW (+).
 - (2) SLOPE: +.
 - (3) COUPLING: AC
 - (4) SOURCE: INT.
 - d. Sweep controls
 - (1) DELAY TIME MULTIPLIER: fully CCW.
 - (2) A & B TIME/DIV: .5 ms.
 - (3) A VARIABLE: CAL.
 - (4) B SWEEP MODE: B STARTS AFTER DELAY TIME.
 - (5) HORIZ DISPLAY: A
 - (6) MAG: OFF.
 - (7) POSITION: midrange.
 - (8) A SWEEP LENGTH: FULL.
 - (9) A SWEEP MODE: AUTO TRIGGER.
 - e. Side panel controls
 - (1) B TIME/DIV VARIABLE: CAL.
 - (2) CALIBRATOR: .1 volts.

Adjust CH 1 vertical POSITION control until the trace is
with the lowest horizontal graticule line.
Connect the 1 kHz CAL connector to the CH 1 input connector
with a BNC cable.
Turn the A LEVEL control toward 0, until the display becomes
stable.
Check the time of one cycle of the observed signal to be 1
millisecond. (2 squares times .5 ms = 1 ms)
Check the amplitude of the observed signal to be .1 volt.
(5 squares times 20 mv = .1 volt)
Repeat steps e through i for channel 2, with the mode selector
set to the channel 2 position.
Disconnect the BNC cable and place it in the drawer.

Setup for waveform analysis (CH 1 and CH 2 when appropriate)
MODE: CH 1 or CH 2.
VOLT/DIV: as required.
INPUT COUPLING: AC.
A & B TIME/DIV: as required.
SOURCE: EXT divided by 10.
A SWEEP MODE: NORM TRIG.
Sync input from J-5 on PULSE GENERATOR or SUPPRESSION
J-2 on trainer.

This procedure is used when taking waveforms.

Setup for voltage readings (DC) (CH 1 and CH 2 when required)
MODE: CH 1 or CH 2.
VOLT/DIV: as required.
INPUT COUPLING: DC.
Center sweep on scope.
Apply signal to scope.
Sweep displacement gives DC level of signal.
This procedure is used when taking DC readings only.

STAND-BY and SECURE procedure

STAND-BY: Turn the INTENSITY control fully CCW.
SECURE: Turn the INTENSITY control fully CCW, and turn the
POWER switch to the OFF position.
Only complete these steps or step when instructed to do so by
instructor.

Additional procedures for beacon simulator (ARM-22A)

Control settings

Place the DIAL DRIVE CW/OFF/CCW switch in the OFF position.
Place the BEARING MOTOR/OFF switch in the BEARING MOTOR

Place the NORTH BURST/OFF switch to the NORTH BURST position.
Place the AUX BURST/OFF switch to the AUX BURST position.
Place the PULSE OUTPUT SELECTOR switch in the SQUITTER position.
Set the 15 cycle PHASE SHIFT control to 0°.
Set the SPACING control switch to the 12 (microsecond) position.
Set the 15 cycle AMP ADJ control fully CCW.
Set the 135 cycle AMP ADJ control fully CCW.
Set the BEARING DIAL to read 270°.
Place the SYNC SELECTOR switch to the 15 cycle position.
Set the BEARING RATE control fully CCW.
Set the RANGE RATE control fully CCW.
Set the VARIABLE RANGE CONTROL to fully CCW. (zero)
Place the RANGE switch in the FIXED position.
Set the FIXED RANGE switch to 0 miles.
Set the EFFICIENCY switch to 85%.

Control adjustments

Set the ARN/21 POWER control to fully CW.
Place the NORMAL/A/A switch in NORMAL position.
Place the FUNCTION SELECTOR switch in the ZERO position.
Press the PUSH-TO-SET button.
Turn the ZERO SET control to adjust meter to zero.
Release the PUSH-TO-SET button.
Place the FUNCTION SELECTOR switch in the SG POWER CALIBRATION position.
Press the PUSH-TO-SET button.
Adjust SG POWER CALIBRATOR control to adjust POWER LEVEL meter to the SET position.
Release the PUSH-TO-SET button.
Set the channel selector to channel 63.
Place the MOD/UNMOD switch to the UNMOD position.
Place the FUNCTION SELECTOR switch in the PULSE OUTPUT position.
Press the PUSH-TO-SET button.
Press in and adjust the RF TRIM control for a peak on the LEVEL meter.
Adjust the OUTPUT SET control until the POWER LEVEL meter reads SET.
Release the PUSH-TO-SET button.
Repeat steps c through q and then continue with step r.
Place the MOD/UNMOD switch to the MOD position.
Steps c through r should be repeated every 15 minutes.
Set the RF LEVEL DBM dial to -50 dbm.
Steps c through r should also be repeated if any channel change is made.

Procedure for setting modulation levels

If modulation levels are not required to be adjusted, set 15 cycle and 135 cycle amplitude controls to the 20% mark on the simulator, and complete steps h and j.

scope to the PULSE OUTPUT Jack J-7 on the PUL unit of the ARM-22A.

b. Modulation adjustments

- (1) Set the PULSE OUTPUT POS/NEG switch to the PO
- (2) Turn the AMPLITUDE control CW until the wavef peak-to-peak.
- (3) Set the VOLT/DIV switch on the oscilloscope t
- (4) Set the vertical position so that the top of t is at the center grid line.
- (5) Set the 15 cycle-OFF-REV switch to the 15 cyc
- (6) Adjust the 15 cycle AMPLITUDE control to obta peak-to-peak signal on the oscilloscope.
- (7) Turn the 15 cycle-OFF-REV switch to the OFF p
- (8) Set the 135 cycle-OFF-REV switch to the 135 c
- (9) Adjust the 135 cycle AMPLITUDE control to obt peak-to-peak signal on the oscilloscope.
- (10) Set the 15 cycle-OFF-REV switch to the 15 cyc

NOTE: Do not turn these controls after this step has been completed. Any change in the amplitude settings will require setup of the modulation levels.

. STANDBY & TURN OFF procedure

- a. STANDBY - gear on (no change).
- b. TURN OFF - place the AC and DC power switches to OFF position, on the power supply and signal generator units. (Only complete this step if instructed to do so by an instructor.)

operational check for a tacan system

. Tacan control panel functions

- a. ID-388 is distance (NAUTICAL MILES) indicator.
- b. ID-250A is course indicator.
- c. Radio set control
 - (1) MODE switch
 - (a) OFF position, equipment inoperative.
 - (b) REC position, azimuth and ID information.
 - (c) T/R position, azimuth, ID, and range information.
 - (d) A/A position, range only.
 - (2) CHANNEL SELECTOR switch - four position switch
 - (3) Volume control - a potentiometer which taps off amount of audio to the pilot's headphones.

. TURN-ON procedure

- a. Set the CHANNEL SELECTOR controls to channel 63.
- b. Set the MODE SELECTOR switch to the REC position.
- c. Allow approximately 90 seconds for the equipment

- (1) Connect an oscilloscope probe from CH 1 input on the scope to J1-3 (1A1A1) on the TACAN.
- (2) Adjust the A SWEEP LENGTH control CCW until the sweep is eight divisions in length.
- (3) With the A&B TIME DIV set on 5 msec, set the A Var control so that one cycle of 15 Hz is observed.

One composite waveform should be observed on the scope. The observed waveform should contain one MRB, eight ARB squitter pulses, and be amplitude modulated by 15 and 1. If the waveform cannot be observed, recheck your work and consult an instructor.

Azimuth accuracy and tracking

The azimuth indicator ID-250A should indicate a bearing to the simulated station.

- (1) Place the DIAL DRIVE switch in the CW position.
- (2) Turn the BEARING RATE control slowly CW to the ninth division.

This simulates the azimuth changing at 20° per second, its minimum performance standard for azimuth tracking. The bearing indicator should track the changing bearing. When the indicator breaks lock-on and starts searching CCW, azimuth does not meet the minimum performance check.

- (3) Place the DIAL DRIVE switch in the CCW position.
- (4) Repeat the check for CCW rotation.
- (5) Set the BEARING RATE control fully CCW.
- (6) Place the DIAL DRIVE switch to the OFF position.
- (7) Set the BEARING DIAL to 270°.

Range accuracy and tracking

(1) Set the TACAN mode selector switch to the T/R position. The range indicator ID-388 should search and lock-on to the range selected.

(2) Set the FIXED RANGE control to 54 (NAUTICAL MILES). The range indicator ID-388 should search and lock-on to 54 (NAUTICAL MILES).

- (3) Place the RANGE switch in the RATE 50 to 100 position.
- (4) Allow the range indicator to lock-on to a range between 50 and 100.

(5) Turn the RANGE RATE control CW five divisions. The range indicator should track in and out between 50 and 100 (NAUTICAL MILES). This simulates the range at 2500 NAUTICAL MILES PER HOUR. If the range does not stay locked on, it does not meet the range tracking minimum performance standard.

- (6) Set the RANGE RATE control fully CCW.
 - (7) Place the RANGE switch in the FIXED position.
 - (8) Set the FIXED RANGE CONTROL to the 0 position.
 - (9) Set the TACAN MODE SELECTOR switch to the REC position.
- ID tone test

- (1) Plug headset into AUDIO IDENTITY jack on the CONTR

Place the NORMAL A/A switch to the A/A position.
Set the TACAN MODE SELECTOR switch to the A/A position.
Range indicator should lock-on to the FIXED RANGE selected.
Place the PULSE OUTPUT SELECTOR switch to the SQUITTER position.
Place the NORMAL A/A switch to the NORMAL position.
Set the TACAN MODE SELECTOR switch to the T/R position.
Over sensitivity
Set the RF LEVEL DBM dial to -80 DBM.
Set the FUNCTION SELECTOR switch to the CW OUT position.
When the TACAN breaks azimuth and range lock-on, return FUNCTION SELECTOR switch to the PULSE OUT position.
TACAN range and azimuth should lock on. If the TACAN lock on it meets the minimum receiver sensitivity check. If range or/and azimuth does not lock on then the TACAN does not meet minimum receiver sensitivity standard.
Return the RF LEVEL DBM dial to -50 DBM.
Transmitter peak power
Place the FUNCTION SELECTOR switch in the ARN/21 POWER position.
Ensure that the ARN/21 POWER control is fully CW.
Press the PUSH to SET button and turn the ARN/21 POWER control CCW until the POWER LEVEL meter reads on the red line.
Read the peak power output of the TACAN from the ARN/21 POWER control.

TITLE: INTRODUCTION TO A TACAN SYSTEM

. Location of equipment parts and subassemblies - 10
 blies and parts below by name and number.

NAME

(1)	_____	1A1A	_____
(2)	_____	1A1A	_____
(3)	_____	1A1A	_____
(4)	_____	1A1A	_____
(5)	_____	1A1A	_____
(6)	_____	1A1A	_____
(7)	_____	1A1A	_____
(8)	_____	1A1A	_____
(9)	_____	1A1A	_____
(10)	_____	1A1A	_____
(11)	_____	_____	_____
(12)	_____	1A1A	_____
(13)	_____	1A1A	_____
(14)	_____	1A1A	_____
(15)	_____	1A1A	_____
(16)	_____	1A1A	_____
(17)	_____	_____	_____
(18)	_____	J-	_____
(19)	_____	J-	_____
(20)	_____	J-	_____
(21)	_____	J-	_____
(22)	_____	J-	_____

11	10	2	8	7	5	5	4	3	2	1
----	----	---	---	---	---	---	---	---	---	---

12

17

16

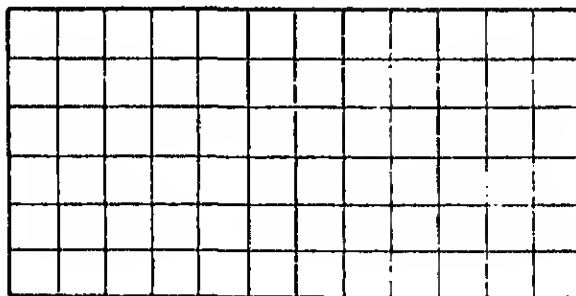
13

14

D tone	()	()
Air-to-air simulation	()	()
Receiver sensitivity	()	()
Transmitter peak power	()	()
Over waveform analysis		

Test Point J1-3 (1A1A1) with the azimuth indicators pointing 70°.

I/F



(1) Describe the observed waveform composition.

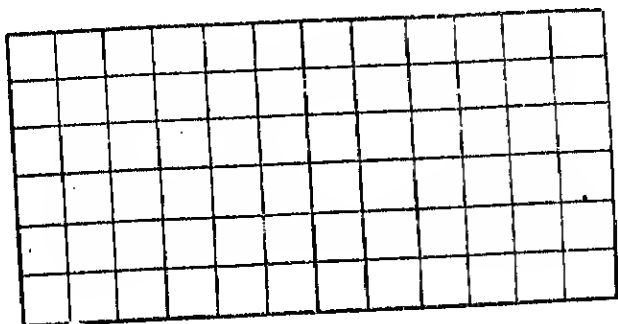
- (a) _____
- (b) _____
- (c) _____
- (d) _____
- (e) _____
- (f) _____

(2) The peak of the observed signal, in relationship to _____ is _____

LEADING/LAGGING by _____ degrees, because (SELECT CORRECT STATEMENT/S).

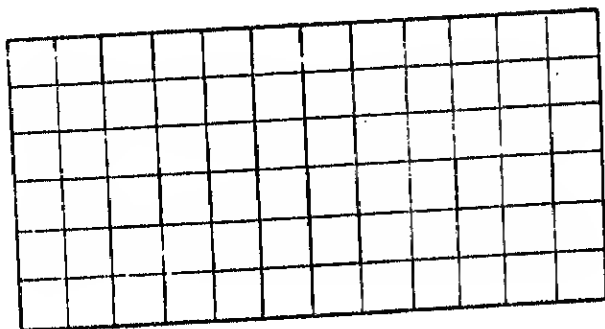
- a) The aircraft's position is 270° from the simulated
- b) Maximum power is directed toward 090° when the MRB transmitted.
- c) The aircraft's position is magnetic East of the simulated station.
- (d) The MRB and peak power are always transmitted at the same time.

Point J1-3 (1A1A1) with the azimuth indicator pointing



-) The peak of the observed signal, in relationship to the station, is LEADING/LAGGING by _____ degrees.
-) The simulated aircraft's position is magnetic _____ the station.

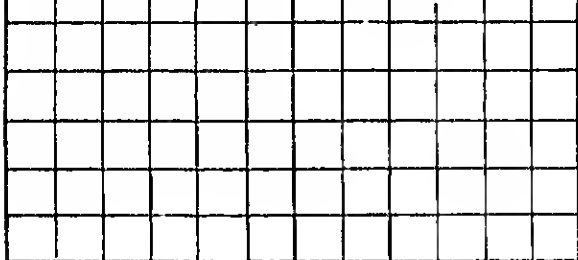
Point J1-3 (1A1A1) with the azimuth indicator pointing



N/F

- (1) The peak of the observed signal, in relationship to the station, is _____ degrees.

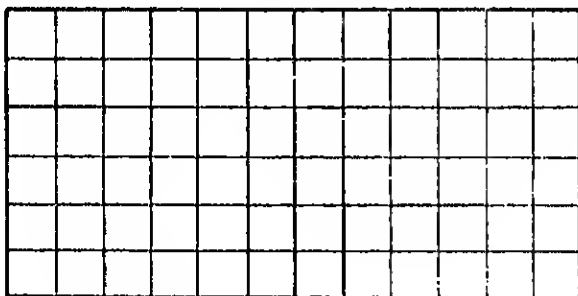
W/F



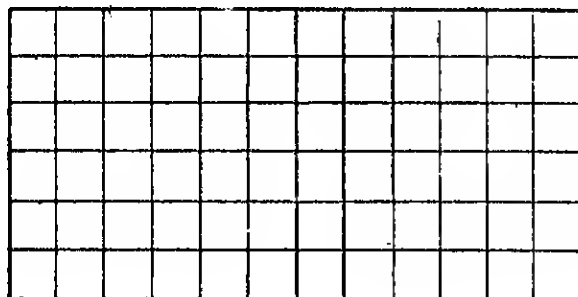
- (1) The peak of the observed signal, in relationship to LEADING/LAGGING by _____ degrees.
- (2) The simulated aircraft's position is magnetic _____ the station.

osite waveform analysis

MAIN Reference Burst with probe at J1-3 (1A1A1)



Auziliary Reference Burst with probe at J1-3 (1A1A1)



INTRODUCTION TO A TACAN UNIT

Answer the following questions:

- What types of information are available by the use
- Range and Azimuth.
 - Azimuth and ID, sometimes range.
 - Range, Azimuth, ID.
 - MRB, ARB, Range, ID, and squitter pulses.

The frequency range of the transmitter is

- 962 to 1024 MHz.
- 1025 to 1150 MHz.
- 1151 to 1213 MHz.
- 1025 to 1150 MHz.

The frequency range of the receiver is

- 962 to 1024 MHz and 1151 to 1213 MHz.
- 962 to 1213 MHz.
- 962 to 1108 MHz and 1109 to 1213 MHz.
- 1025 to 1150 MHz.

How many channels are available in the Tacan transco

- 135.
- 126.
- 120.
- 4.

How many crystals are used to make these channels a

- 15.
- 136.
- 126.
- 115.

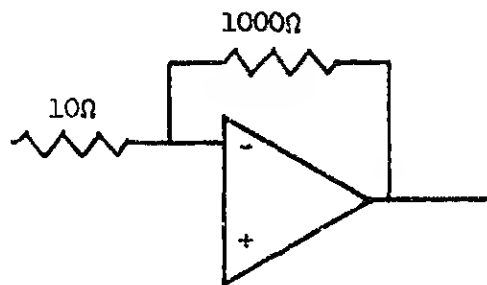
In order to display range and azimuth, the FUNCTION switch must be in the

- OFF position.
- REC position.

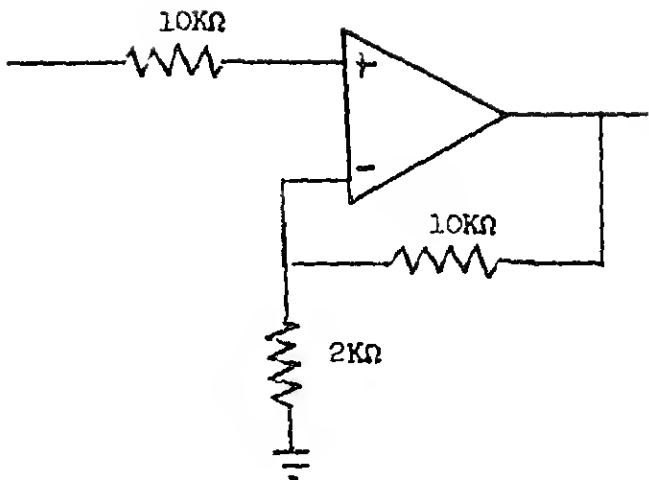
of the Tacan system is

d. 2000 watts.

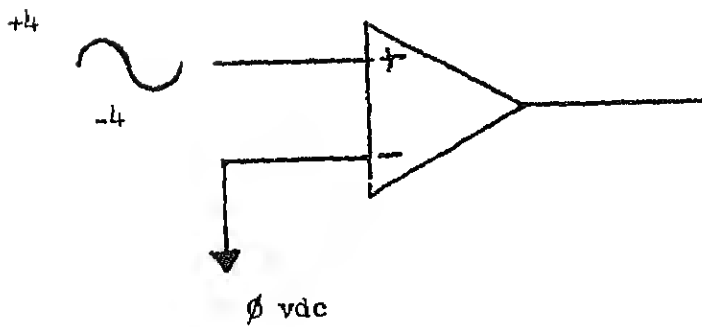
9. The bearing accuracy of the Tacan is
- $\pm 2/9^\circ$.
 - $\pm 5.0^\circ$.
 - $\pm 0.5^\circ$.
 - $\pm 9/2^\circ$.
10. The minimum receiver sensitivity is
- 80 dbv.
 - 80 dbm.
 - 82 dbv.
 - 82 dbm.
11. The warm-up time of the Tacan is
- 24 sec.
 - 60 sec.
 - 120 sec.
 - 90 sec.
12. The range accuracy is
- $\pm 2/9$ miles.
 - ± 0.5 miles.
 - ± 5.0 miles.
 - $\pm 9/2$ miles.
13. The Tacan is operating on channel 56
- The airborne transmitter frequency is.. _____
 - The airborne receiver frequency is..... _____
 - The beacon transmitter frequency is.... _____
 - The beacon receiver frequency is..... _____
14. Determine the value required in the following Ic'
-



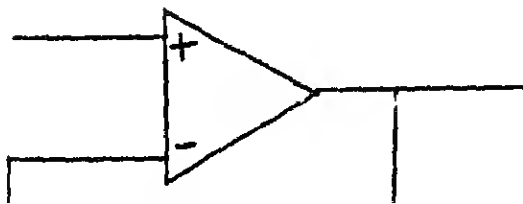
b.



c. Draw output signal



d. What type of circuit



ated circuits used in device 8H7 are listed in figure 1, onal description follows on each IC.

	P/N	Function
rner	709	Operational Amplifier, Comparator Multivibrator, Oscillator
	715	Operational Amplifier
	741	Integrator, Bandpass Filter, Op A
	946	NAND GATE
	MC1469R	Voltage Regulator

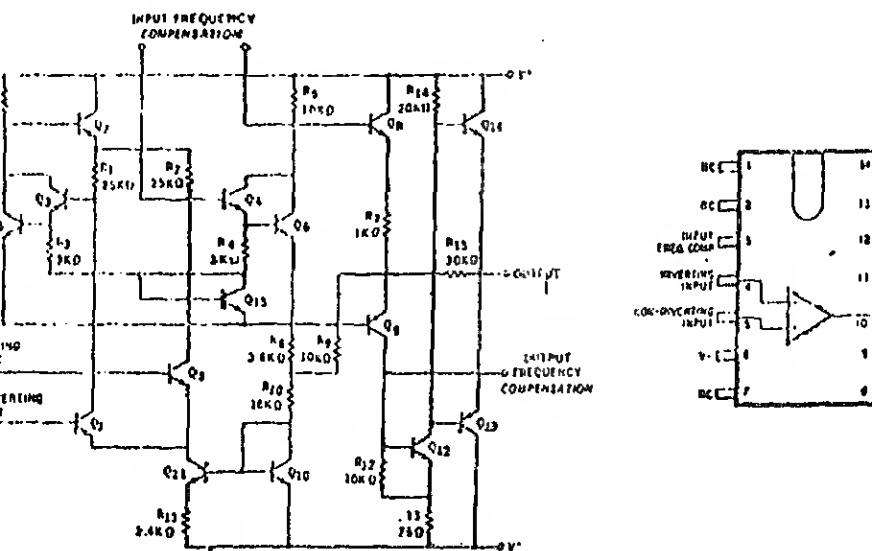
Figure 1

Performance Operational Amplifier 709C. The 709C is a high performance operational amplifier constructed on a single silicon chip using the Epitaxial Process. It features low offset, high input impedance, large input common mode range, high output swing under low power consumption. The 709C displays exceptional temperature stability and operates over a wide range of supply voltages with no degradation of performance. The amplifier is intended for use in data systems, high impedance analog computers, in low-level instrumentation applications and for the generation of special linear and non-linear transfer functions. Figure 2 lists the absolute maximum ratings of the amplifier and figure 3 illustrates the schematic and connection of the 709C.

High Speed Operational Amplifier 715. The 715 is a high speed monolithic operational amplifier constructed on a single silicon chip using the epitaxial process. The 715 features fast settling time, low rate, low offsets, and high output swing for large signal applications. The device also displays excellent temperature stability over a wide range of supply voltages. The 715 is well suited for use in A-to-D and D-to-A converters, active filters, deflection amplifiers, video amplifiers, phase locked loops, multiplexed precision comparators, sample and holds, and general feedback applications requiring d-c wide bandwidth operation. Figure 4 lists the absolute maximum ratings of the amplifier and figure 5 illustrates the schematic and connection diagrams of the 715.

Parameter	
Supply voltage	$\pm 18\text{V}$
Internal power dissipation (for ambient temperatures to $+70^{\circ}\text{C}$)	250 mW
Differential input voltage	$\pm 5.0\text{V}$
Input voltage	$\pm 10\text{V}$
Output short circuit duration ($T_A = 25^{\circ}\text{C}$)	5 sec
Storage temperature range	-65°C
	-55°C
Operating temperature range	0°C to $+70^{\circ}\text{C}$
Lead temperature T0-99 (Soldering, 60 sec)	300°C
	260°C
	dual-in-line (soldering, 10 sec)

Figure 2

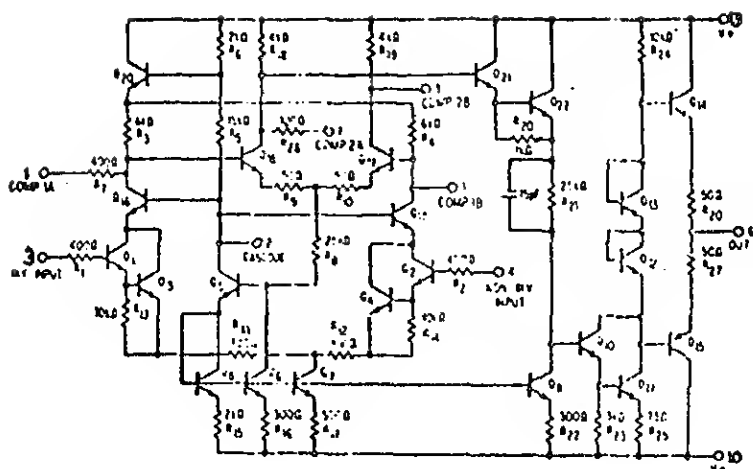


Parameter	Rating
Supply Voltage	$\pm 18\text{V}$
Maximum Power Dissipation (for ambient temperatures to $+125^{\circ}\text{C}$.)	500mW
Differential Input Voltage	$\pm 15\text{ V}$
Output Voltage	$\pm 15\text{ V}$
Operating Temperature Range	-65°C to $+150^{\circ}\text{C}$
Storage Temperature Range	-55°C to $+125^{\circ}\text{C}$
Maximum Soldering Temperature (Soldering, 60 seconds)	300°C

Figure 4

Performance Operational Amplifier 741C. The 741 C is a high performance monolithic operational amplifier constructed on a single chip, using the Planar Epitaxial Process. It is intended for a wide range of analog applications. High common mode voltage rejection and absence of "latch-up" tendencies make the 741C ideal for use as a voltage follower. The high gain and wide range of operating voltages provide superior performance in integrator, summing amplifier, and inverter applications. The 741C is short circuit protected and does not require external components for frequency compensation. The wide bandwidth and low roll-off ensures stability in closed loop applications. Figure 8 lists the absolute maximum ratings of the amplifier and Figure 9 illustrates the schematic and connection diagrams of the 741C.

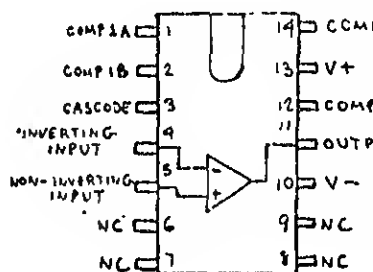
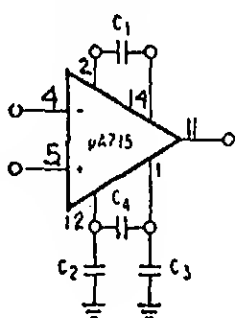
74946. The 946 is an active low power NAND gate composed of a CMOS technology. The gate has low power, medium speed, and full use of wired-OR capability. Figure 8 lists the absolute maximum ratings of 946 operation and figure 9 illustrates the 946 schematic gate circuit, logic symbol and connection diagrams.



COMPENSATION COMPONENTS VALUES

USED COMP AIN	C_1	C_2	C_3	C_4
100	10 pF	—	—	—
100	50 pF	—	250 pF	—
100	100 pF	—	—	200 pF
100	500 pF	2000 pF	1500 pF	—

FREQUENCY COMPENSATION
CIRCUIT



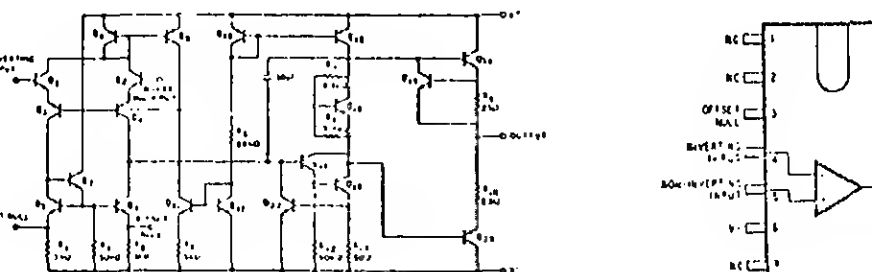
Parameter	Rating
Supply voltage	$\pm 18\text{V}$
Internal power dissipation	500 mW
Differential input voltage	$\pm 30\text{V}$
Output voltage (see Note 1)	$\pm 15\text{V}$
Storage Temperature range TO-99	-65°C to $+175^{\circ}\text{C}$
Package type dual-in-line	-55°C to $+125^{\circ}\text{C}$
Operating temperature range	0°C to $+70^{\circ}\text{C}$
Lead temperature (soldering, 60 sec) TO-99	300°C
Lead temperature (soldering, 10 sec) dual-in-line	260°C
Input short circuit duration (see Note 2)	Indefinite

NOTE

For supply voltages of less than ± 15 volts dc, the maximum input voltage is equal to the supply voltage.

The short circuit may be to ground or to either supply.

Figure 6

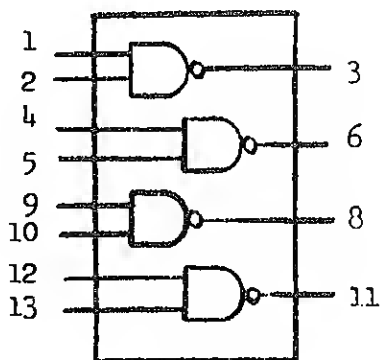
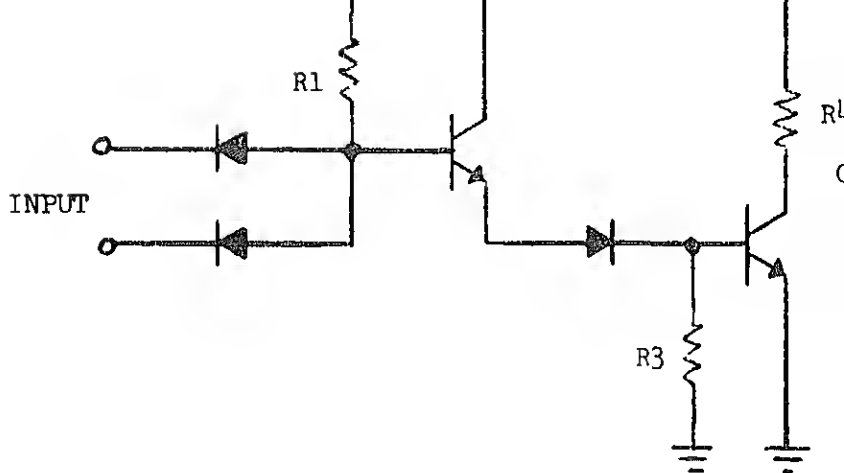


VOLTAGE REGULATOR MC1469R. The monolithic voltage regulator is designed to deliver continuous load current to 500 milliamperes with a maximum input voltage of 40 volts d-c, or load current of 1.0 ampere when current boosted through use of a single external transistor. Stability is maintained by the addition of a compensation capacitor (with or without current boosting). Table 10 lists the maximum ratings and figure 11 illustrates the pin connections and connection diagram of the MC 1469R.

ABSOLUTE MAXIMUM RATINGS OF 946

Parameter	Rating
Storage temperature	-65°C to +175°C
Operating temperature (ambient) under bias	-55°C to +125°C
Input pin potential to ground	-0.5v to +0.5v
Input current, pulsed 1 second	12v
Output voltage, applied to input	-15v to +15v
Output voltage applied to output when output is high	V_{CC}
Output current, into inputs	1.0 ma
Output current into output when output is low	
(except 9932 and 9944)	30 ma
Output current into output when output is low	
(9932 and 9944)	100 ma
Soldering temperature (soldering, 60 seconds)	300°C

Figure 8



PIN 14 = V_{CC}
 PIN 7 = GROUND

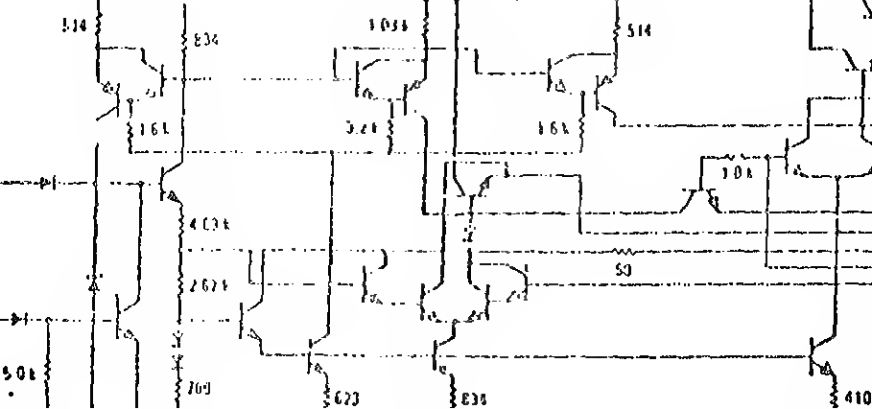
NAND Gate 946 Schematic and Connection Diagram

Figure 9

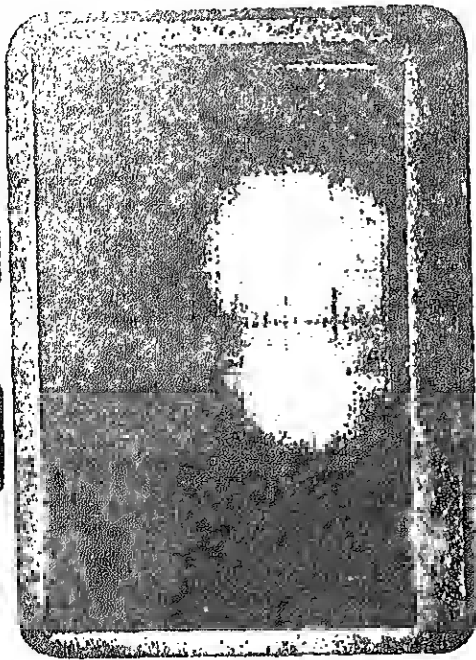
MAXIMUM RATINGS OF MICROOR

Parameter	Symbol	Value
Supply Voltage	V_{in}	35
Input Current	I_{in}	600
Output Current, pin 2	$I_{pin 2}$	10
Output Current, pin 3	$I_{pin 9}$	5.0
Power Dissipation and Thermal Characteristics		
at 25°C	P_D	3.0
at $T_A = 25^\circ C$	$1/\theta_{JA}$	24
Thermal Resistance, Junction to Air	θ_{JA}	41.6
at 25°C	P_D	17.5
at $T_C = 25^\circ C$	$1/\theta_{JC}$	140
Thermal Resistance, Junction to Case	θ_{JC}	7.15
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150

Figure 10



TYPE 453 OSCILLOSCOPE



DELAY TIME MULTIPLIER
1.0

SLOPE

CO

AC

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10

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BEARING



AT 3 AMP

SPARE FIXED RANGE

100% 14 2107
100% 14 2107
100% 14 2107

AUXILIARY

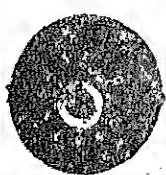


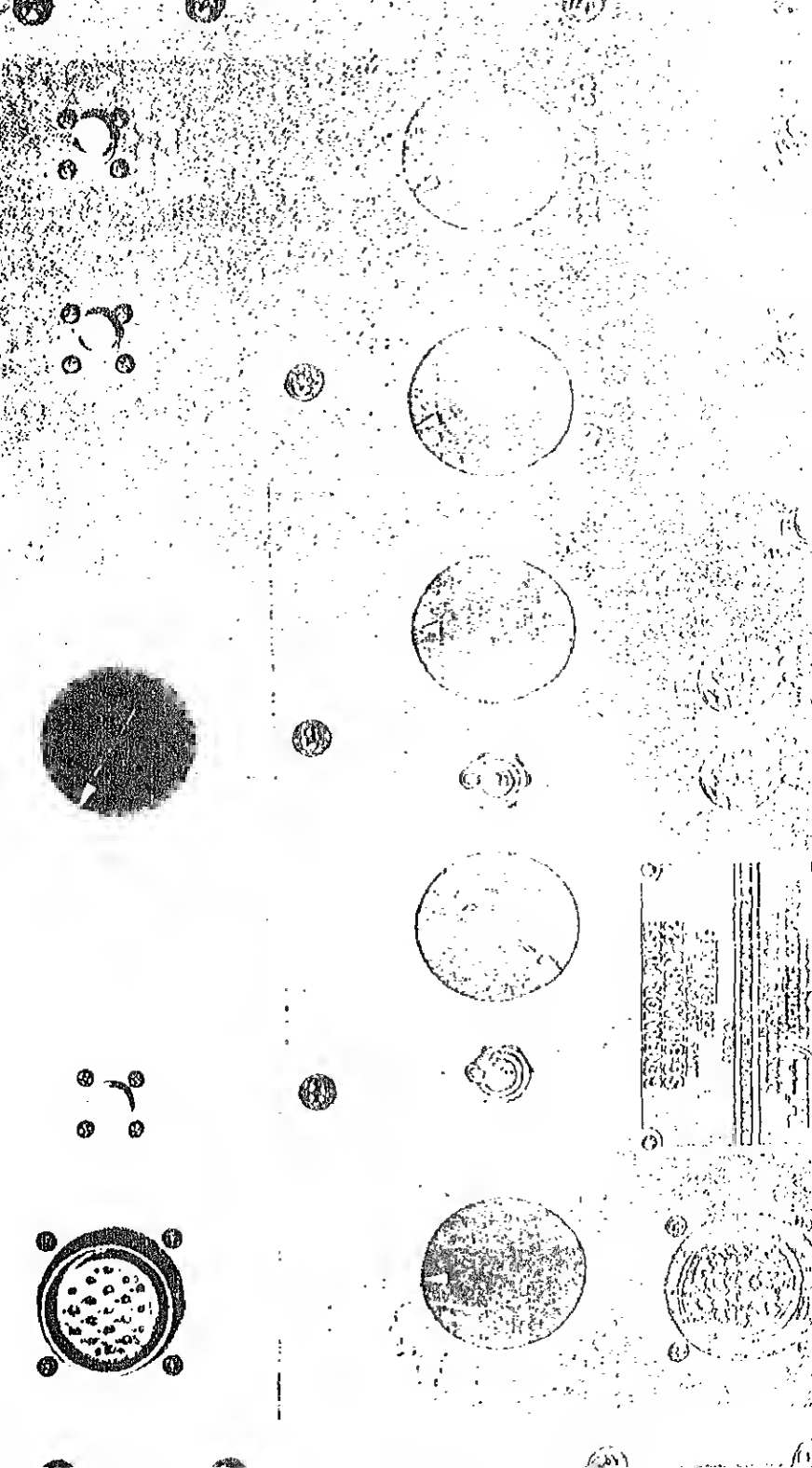
TYPE 17935
DATE 12-19-66
C/O 6160

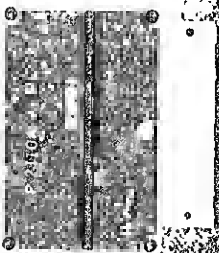
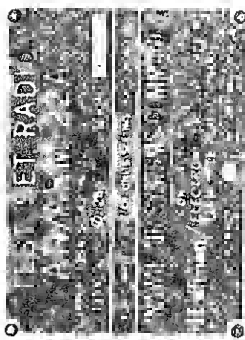
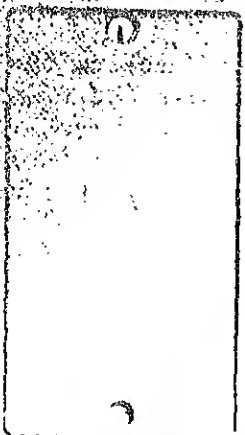
RANGE



VARIABLE RANGE







BLOCK DIAGRAM ANALYSIS

over the following questions.

The RF module is composed of what sections?

- a. _____
- b. _____
- c. _____
- d. _____
- c. _____

The Antenna Selector module performs what function/s

- a. Allows the use of one antenna for receive and trans
- b. Selects the proper antenna for receive and trans
- c. Allows the use of two antennas for air-to-air op
- d. Selects the antenna with the first usable signal

One of the purposes of the 4045.7 Hz oscillator in t

- a. provide fine range accuracy.
- b. provide coarse range accuracy.
- c. provide fine azimuth accuracy.
- d. provide coarse range and azimuth accuracy.

The purpose of the countdown MVB is to

- a. establish the correct PRF.
- b. control the correct PRF.
- c. generate a pulse at a 22-30 Hz rate in search.
- d. generate a pulse at a 120-150 Hz rate in track.

The The d-c voltage from the distance measuring pote
the R,M,M, is controlled by

- a. speed of rotation.
- b. direction of rotation.
- c. the indicated range.
- d. the range from the beacon in search.

The gate length of the early gate former and late ga

- a. 12 μ sec early gate, 12 μ sec late gate.
- b. 24 μ sec early gate, 24 μ sec late gate.
- c. 24 μ sec early gate, 12 μ sec late gate.
- d. 24 μ sec late gate, 12 μ sec early gate.

The memory of the range circuits is how long? _____

Eliminates the MRB and ARB's and controls the peak detector.
Eliminates the North Burst and controls the peak detector.
Ensures that the North Burst and the ARB's are not removed
from the video before detection.

Control the peak detector only when the MRB and ARB's are present.

15 Hz filter and phase adjust

Filters out the 15 Hz.

Filters the 135 Hz signal out, maintains a constant amplitude
signal out.

Filters out the 15 Hz and supplies an unprocessed signal to the
5% level detector and an unprocessed signal to the filter and
phase inverter.

Filters out the 135 Hz and supplies an unprocessed signal to the
5% level detector and an unprocessed signal to the filter and
phase inverter.

40° coincidence circuit output will

switch the bearing circuits from 15 Hz track to track.

enable the search control to switch the feedback from
regenerative to regenerative.

Have a positive 13 volt output in track.

Have a positive 13 volt output in search.

What is the purpose of the 5% level detector, and what function
it perform?

135 Hz phase comparator output is applied to the magnetron
drivers when

15 Hz filter on the 135 Hz filter accomplish what function?

Change a sine wave to a square wave.

Change a square wave to a sine wave.

Invert and amplify.

Provide a phase shifted sine wave.

15 Hz track the indicator is

within a 40° sector at $\pm 2/9$ of a degree.

rotating maximum CCW.

within a 15° sector.

within or at the correct 40° sector.

ITILE: RANGE DECODER CIRCUIT ANALYSIS

1. Decoder circuits

4.

(1)

[illegible][illegible]

(2)

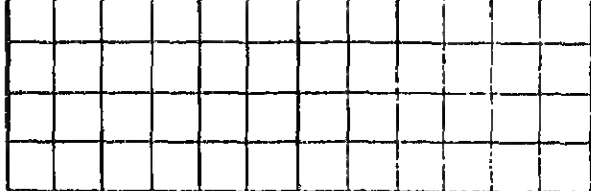
b. Describe the circuit operation which cause the MRB between the two signals observed.

2. Amplifier and limiter section

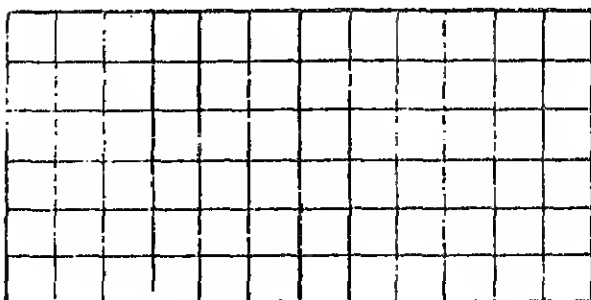
9.

(1)

[illegible]



(3)



9. List where these signals are applied and what they for.

(1)

(2)

(3)

AGC circuits

1.

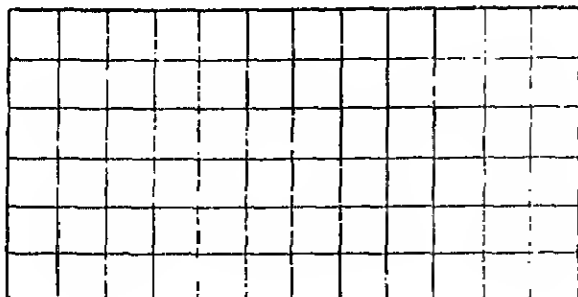
(1) _____ vdc

(2) _____ vdc

(3) _____ vdc

tone circuits

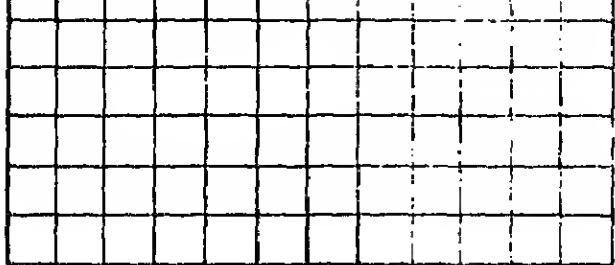
(1)



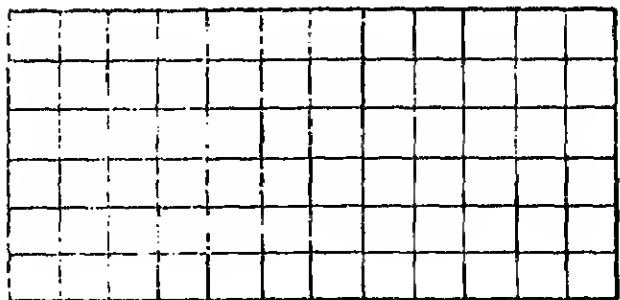
(2)



What caused the difference between the tone and squitter waveforms at J1 pin 8? _____



(2)



b.

(1) What caused the difference between the two wa
served? _____

(2) What is the purpose of the signal observed at
of Q9? _____

Answer the following questions:

1. After decoding, the MRB will appear as
 - a. 12 pulse pairs spaced 30 μ sec apart.
 - b. 11 pulses spaced 24 μ sec apart.
 - c. 12 pulses spaced 24 μ sec apart.
 - d. 12 pulses spaced 30 μ sec apart.
2. After decoding, the ARB will appear as
 - a. 12 pulses spaced 24 μ sec apart.
 - b. 11 pulses spaced 12 μ sec apart.
 - c. 11 pulses spaced 24 μ sec apart.
 - d. 12 pulses spaced 12 μ sec apart.
3. In the pulse limiter section of the decoder, R29, vide what function?
 - a. A 12 μ sec delay.
 - b. A 11 μ sec delay.
 - c. A 2 μ sec delay.
 - d. A phase shift of 90°.
4. The reference voltage of AR2 is changed when in a positive reference; why?
 - a. In normal operation, the static output of AR1
 - b. In A/A operation the output of AR2 is a static
 - c. In normal operation, the static output of AR1
 - d. In A/A operation, the input signal is referen
5. At J1-13 (1A1A1) with no ID tone being received, ringing is present. Why?
 - a. The ARB's and MRB's are sub-harmonics of 1350
 - b. R36 is unadjusted.
 - c. Abnormal operation.
 - d. Relay K2 is energized.
6. AR6 accomplishes what function?
 - a. Inverter
 - b. Comparator
 - c. Voltage follower
 - d. Operational amplifier
7. The voltages on pin 5 of AR6 are limited by what?
 - a. R63, CR12, and CR13.
 - b. R62, R63, and CR12.
 - c. R61, R63, R60, CR12, and CR13.
 - d. R61, R63, R62, CR12, and CR13.

Range interrogations.

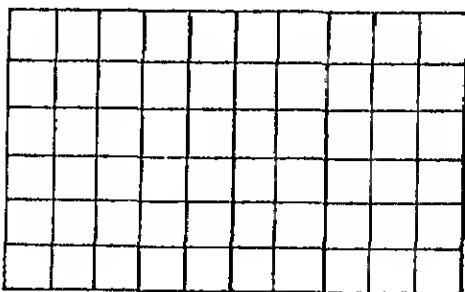
TITLE: RANGE "A" MODULE ANALYSIS

1. Countdown multivibrator circuits

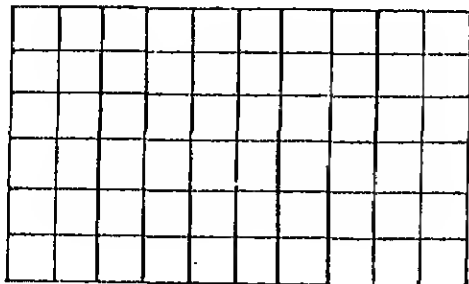
a. Pulse former ARI

(1)

(a)

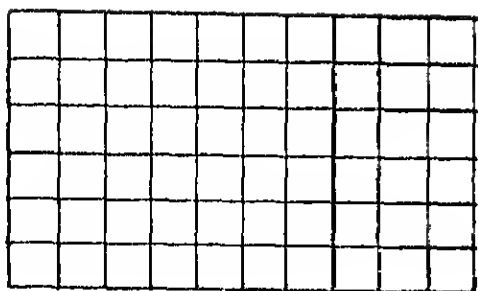


(b)



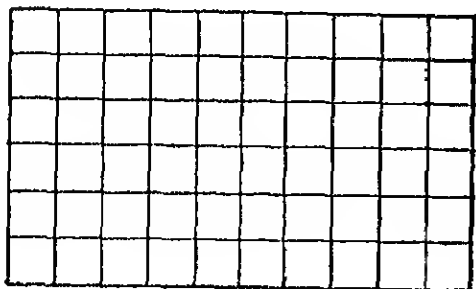
(2) What is the purpose of the signal observed at t

(a)



Pin
AR2
RAM

(b)

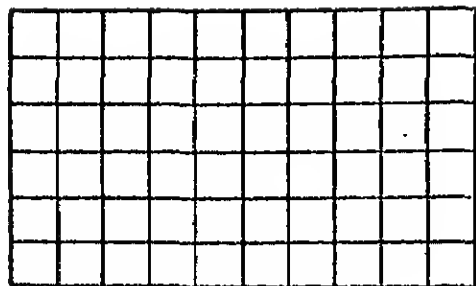


J1-1
RAM

(a) State the purpose of the astable timing oscillator.

(b) What caused the difference in the signal at the output when the equipment switched from search to track?

(a)



PIN 10
AR3
RAM

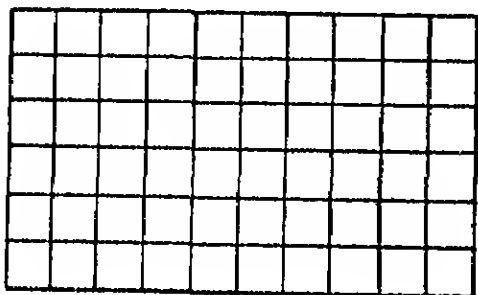
(b) _____ vdc Pin 5 AR3 (Q1 removed)

(a) The change in voltage at pin 5 of AR3 simulates what

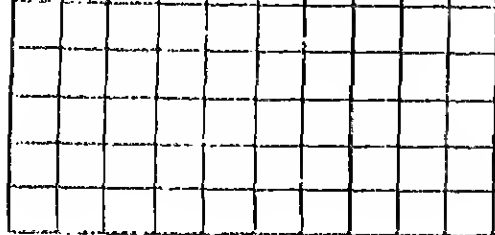
(b) What is the purpose of this change?

gger Q2

(a)



Junct1
R23 &
RAM

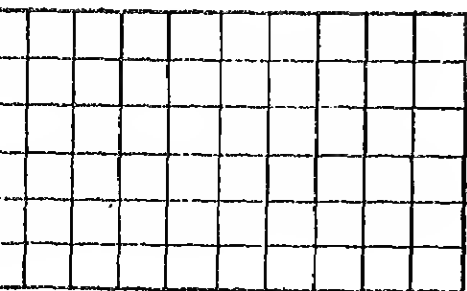


Pin 2
RAM

What portion of the astable timing oscillator output triggers this signal?

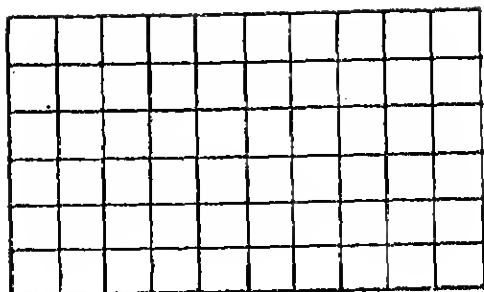
Change gate circuits

Flip-flop (UB2 NAND Gate)



Pin 5
U2B
RAM

What is the purpose of the flip-flop? _____



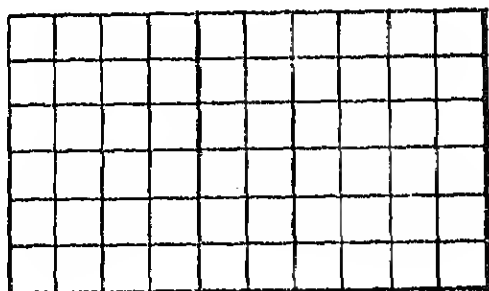
(2)

(a) What is the output of AR4 used for? _____

(b) _____

c. Integrator AR5

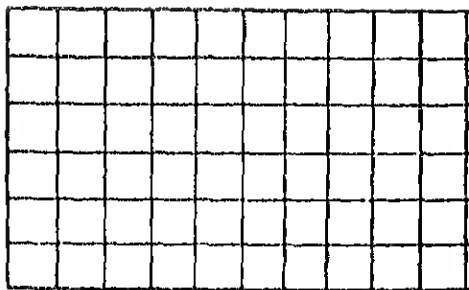
(1)



(2)

(a) What is the purpose of Q3 in the integrator? _____

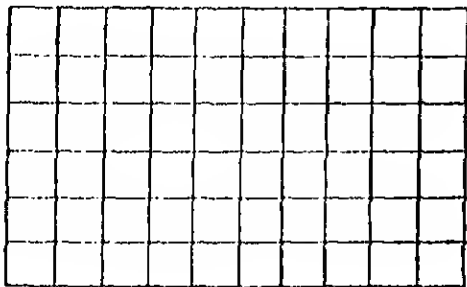
(b) What is the purpose of the output from AR5? _____



J1-6
RAM

st the two purposes of AR6's output. _____

One Shot AR7

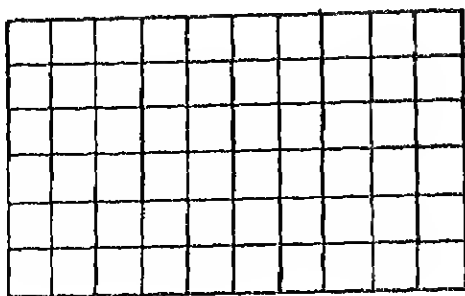


J1-9
RAM

t is the purpose of this signal? _____

a. Fine Range Pulse Amplifier AR8

(1)

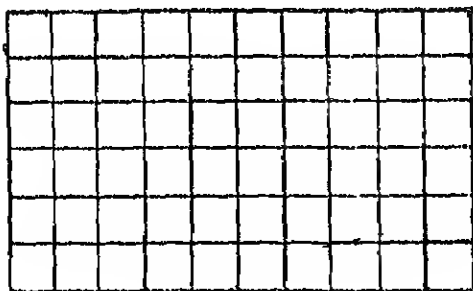


Pin
AR8
RAM

(2) Describe the operation which causes the different waveforms observed? _____

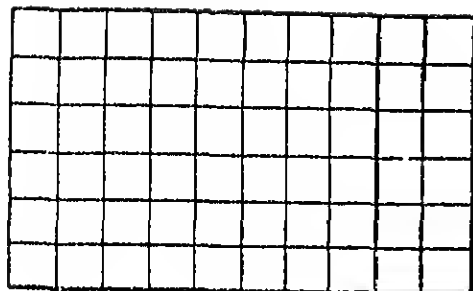
b. Fine Range Pulse Generator AR9's Input to U2C

(1)



J1-
RAM

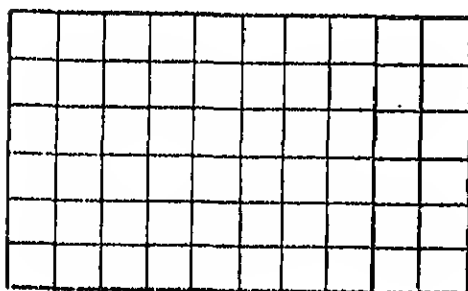
(2) What is the purpose of this signal? _____



J1-9
RAM

Output Selector Nand Gate U2C

(1)

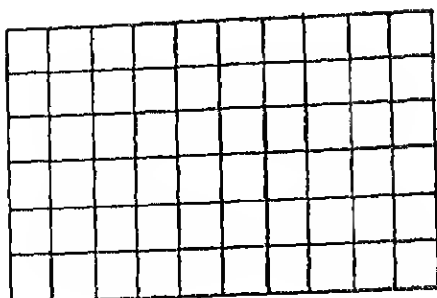


Pin 8
U2C
RAM

(2) Assuming the equipment is in a search mode, what would occur at the output of the NAND gate?

a. Fine Range Pulse Amplifier AR0

(1)

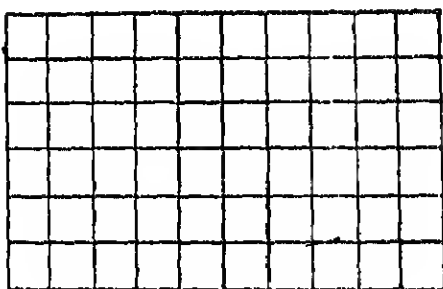


Pin
AR0
RAM

(2) Describe the operation which causes the different waveforms observed? _____

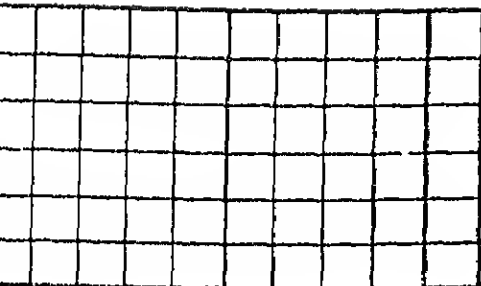
b. Fine Range Pulse Generator AR9's Input to U2C

(1)



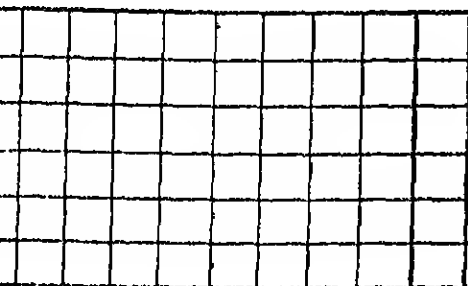
J1-
RAM

(2) What is the purpose of this signal? _____



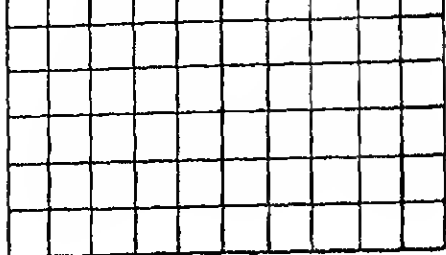
J1-9
RAM

put Selector Nand Gate U2C



Pin 8
U2C
RAM

Assuming the equipment is in a search mode, what would
occurring at the output of the NAND gate?

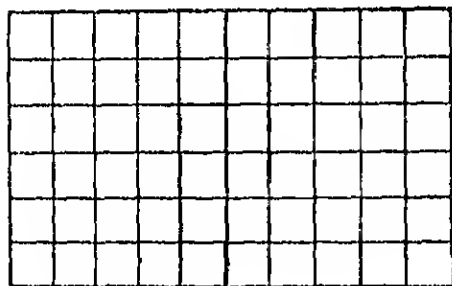


JL
RA

(2) What is the purpose of the output from AR10?

b. Early Gate Former AR11

(1)

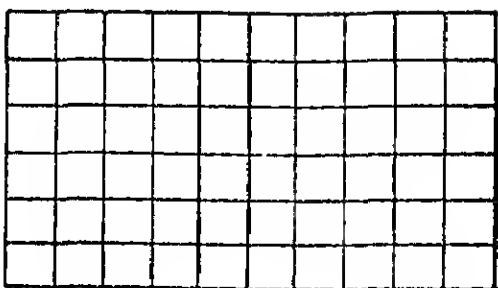


JL-11
RAM

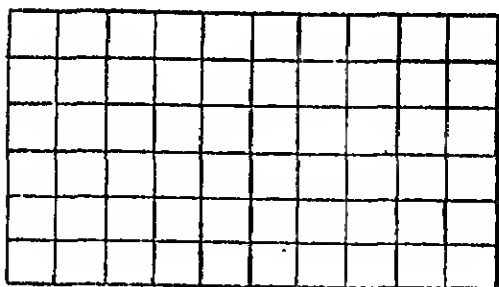
(2) What determines the duration of the output?

a.

(1)

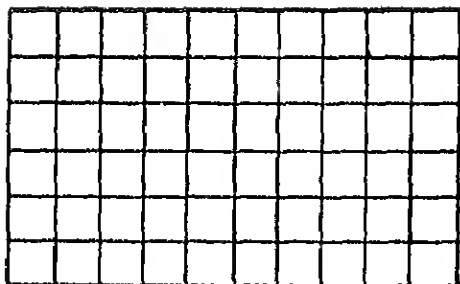


(2)



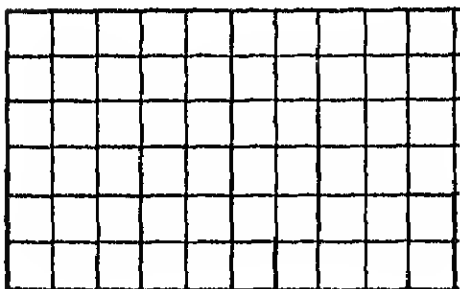
b. Where is the output from ARL2 applied? _____

(1)



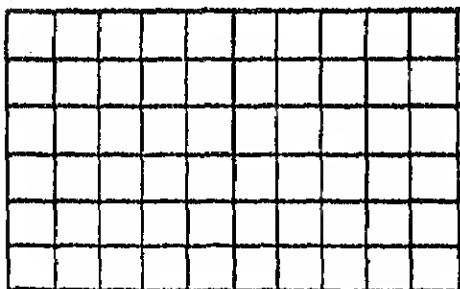
Pin
UIA
RAM

(2)

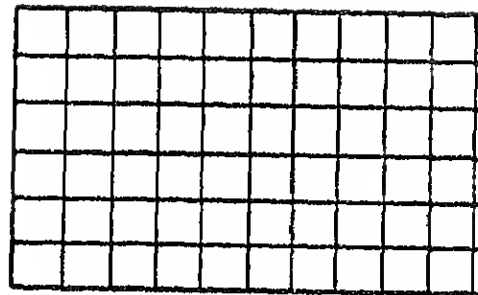


J1-
RAM

(3)

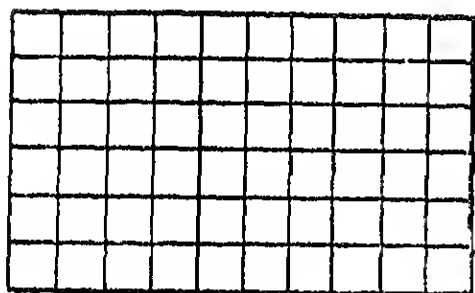


Pin
UIA
RAM



Pin 13
U2D
RAM

(5)



J1-15
RAM

(1) What circuit prevents a late coincidence output during coincidence time?

(2) Describe the operation of the coincidence circuits?

the following questions:

on 5 of AR2, what signals could be observed? _____

and C2 are connected in parallel with C3 in the _____

and R12 function as a _____ Why? _____

statically _____ and will be _____ when a transmitting pulse is received.

functions as a _____

of U2B is statically

13 volts.

13 volts.

5 volts.

5 volts.

functions as a _____

in why the output of AR6 is only a negative spike?

output of the 190 μ sec single shot is the _____

pin 9 of U2C goes _____ and pin 10 goes _____ the output will be a negative spike whose length is the same as _____.

in why the output of AR2 is constantly moving or changing

input to AR8 will be phase shifted 18° for every _____ of indicator rotation.

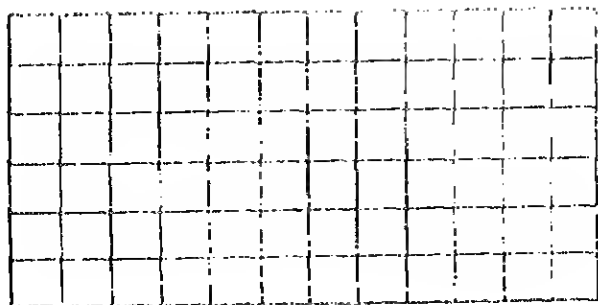
FROM _____

Describe the characteristics and purpose of the signal
pin 2 of J1.

Late coincidence circuits

a.

(1)

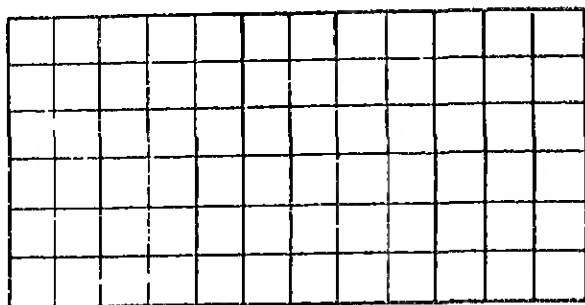


(2) _____ vdc

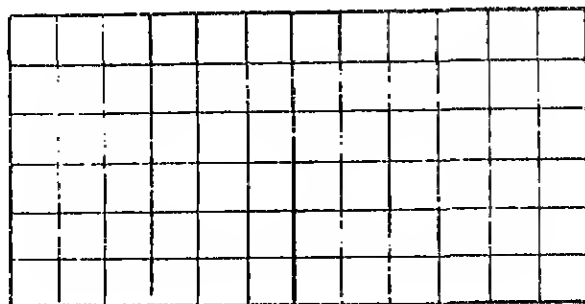
(3) _____ vdc

b. What is the function of the late coincidence circuit search and track?

(1)



(2)



(3) _____ vdc

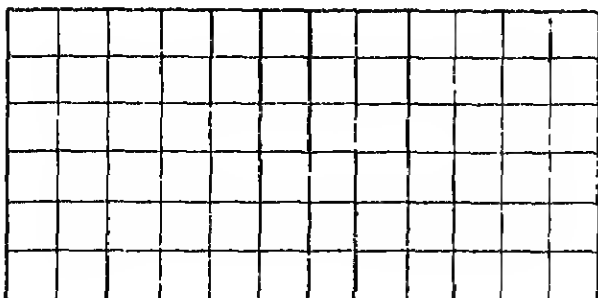
(4) _____ vdc

b.

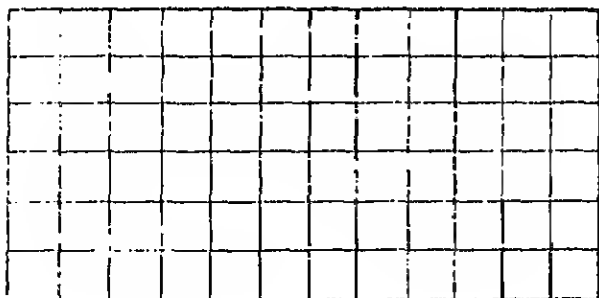
(1) What is the purpose of the track AND Gate? _____

early and late coincidence amplifiers

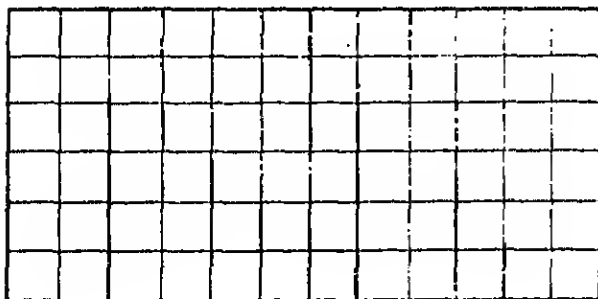
(1)



(2)



(3)





(5) _____ vdc

(6) _____ vdc

b.

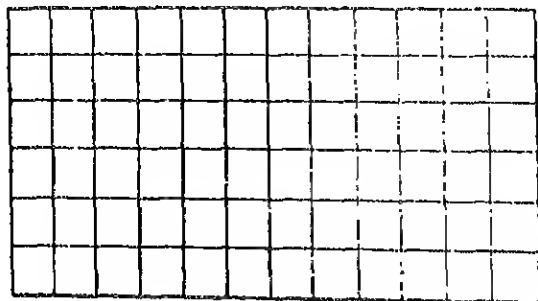
(1) What determines the charge on C5 and C6 in track

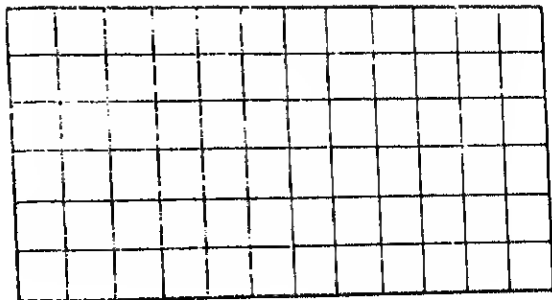
(2) Explain the voltages observed on C5 and C6 while
equipment was tracking in range rate.

4. Magnetic amplifier control circuits

a.

(1)





b. What is the purpose of these signals? _____

5. Memory circuits

a.

(1) _____ vdc

(2) _____ vdc

(3) _____ vdc

(4) _____ vdc

b.

(1) What is the memory time of AR7? _____

(2) When does the output from AR8 occur?

Answer the following questions:

1. Explain why the MAG AMP control circuits are to count out at a maximum speed in the search

2. What relay provides the countdown ground to energized?

3. When K2 is deenergized the range circuits switch to _____.
4. A _____ signal will be present at P2-_____.

5. What is the purpose of the signal referred to

6. Which mag amp drive drives the indicator from miles? _____
7. What is the condition of the control relays mode?

8. What is necessary to cause the RBM to switch to the track mode of operation _____
9. If the early coincidence pulse was wider than the RBM, the charge on C5 would be _____
_____ would be _____.
_____ts have a memory of _____

11. When will the charge on C5 and C6 be equal?
12. What is the purpose of the RBM? _____

the following questions:

What type of circuits are the input circuits to ARL and A

_____ is the memory capacitor for the ASM.

When the ASM is in the search mode of operation AR3's out
_____ volts.

Monostable MVB has a switching time of _____ which
is controlled by _____.

Identification signal is transmitted from the ground
by _____.

Memory time of the ASM is _____.

What does the ASM not go into the search mode of operation
on identification signals?

Explain how the ASM is switched from the search to the track
operation.

When the track mode of operation, what would be seen at J1-

Answer the following questions:

1. What is the purpose of CR807? _____

2. R803 has no current flow when _____
3. CR808 is used for what purpose? _____

4. Q814, R833, and CR823 provide _____
5. Briefly explain how T802 and associated circuits change in input voltage.

6. 60 seconds after power is applied _____ vdc will
TP-803 and _____ seconds later _____ voltage will
7. What would cause an increased voltage drop across C

8. Q803, Q804, Q805, and Q806 are connected as what? _____

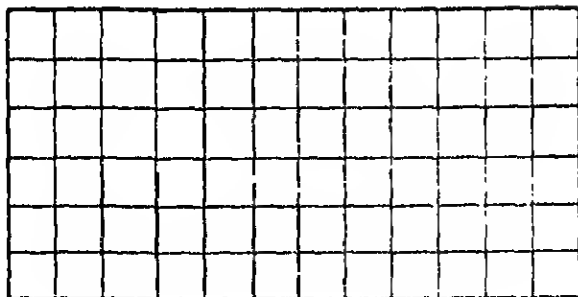
- 26 vac is defective, a possible problem is _____

E: BEARING DECODER MODULE ANALYSIS

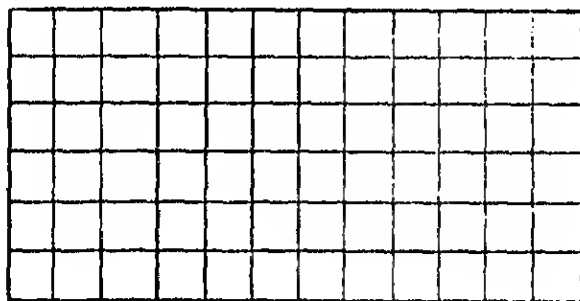
1. Detection of amplitude modulated video

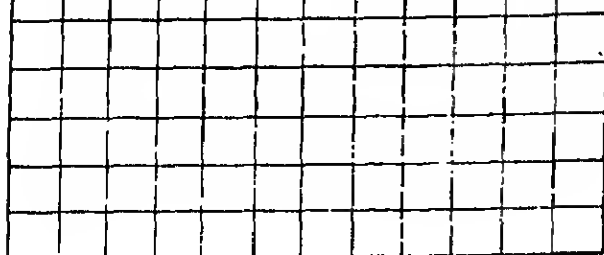
a.

(1)



(2)

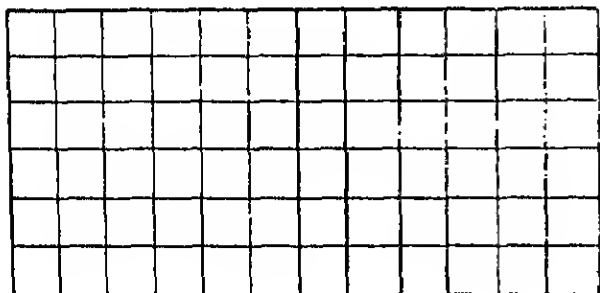


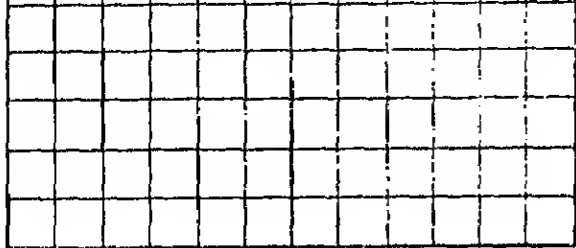


When is Q1 cut off? _____

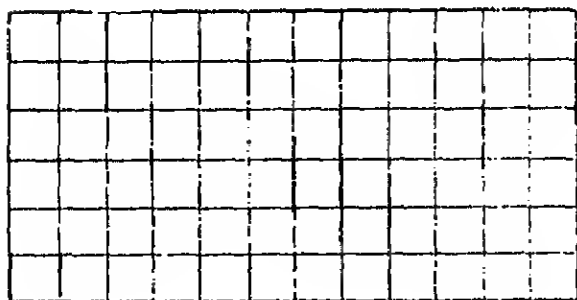
When is Q2 cut on? _____

urst detection

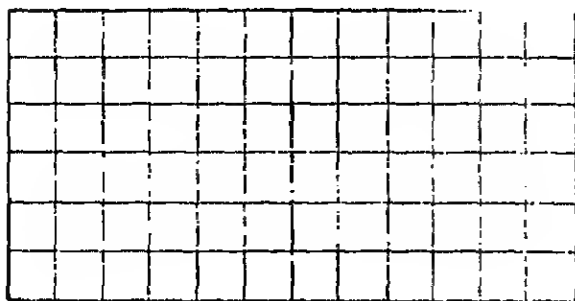




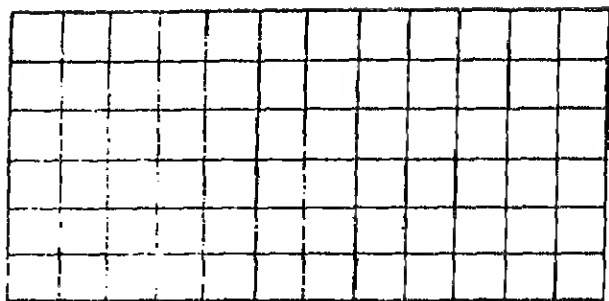
(3)



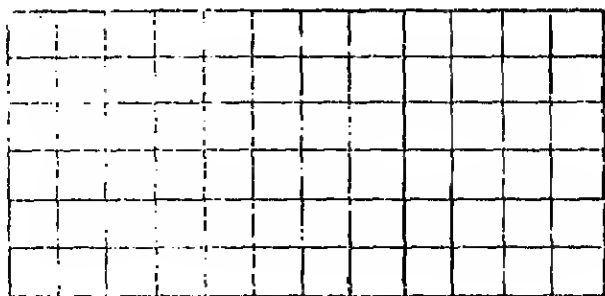
(4)



(6)



(7)



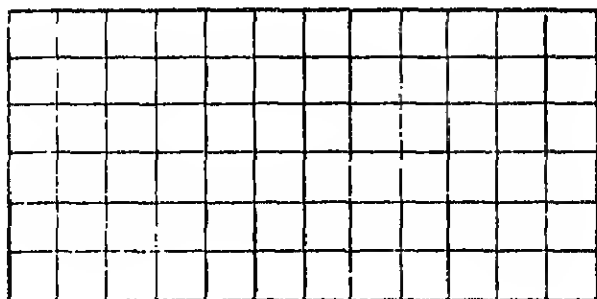
(8)



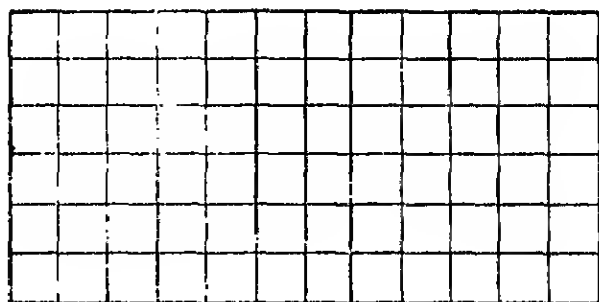
(2) Explain the purpose of the 15 Hz ringing burst.

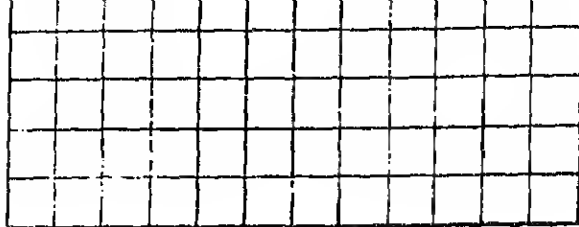
Auxiliary Burst detection

(1)

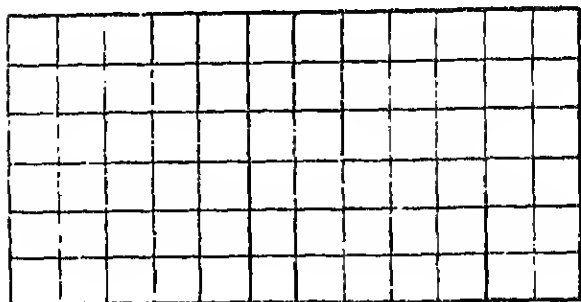


(2)





(4)



b.

- (1) What frequency is the tank circuit L1, R26, and C27 to?

- (2) Explain the purpose of the input from AR4 to the multivibrator.

b.

- (1) Explain the purpose of the input to pin 5 of AR

- (2) Explain the purpose of the 15 Hz ringing burst.

Auxiliary Burst detection

2.

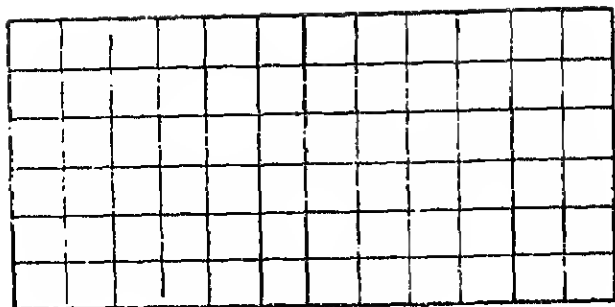
- (1)

[illegible]

- (2)

[illegible]

(4)



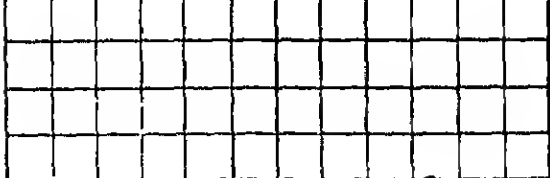
b.

- (1) What frequency is the tank circuit L1, R26, a to?

- (2) Explain the purpose of the input from AR4 to multivibrator.

Answer the following questions:

1. The output of AR5, the AUX BURST IDENTIFIER is
 - a. an 83.3 kHz sine wave.
 - b. 11 pulses, 12 μ sec apart.
 - c. 8 pulses for every antenna revolution.
 - d. 9 pulses for every antenna revolution.
2. The input to Q12, the AUX BURST DETECTOR is
 - a. 11 pulses, 12 μ sec apart.
 - b. 12 pulses, 12 μ sec apart.
 - c. 12 pulses, 30 μ sec apart.
 - d. Delayed negative limited video.
3. The static condition of Q1 and Q2 is
 - a. Q1 and Q2 both on.
 - b. Q1 and Q2 both off.
 - c. Q1 off and Q2 on.
 - d. Q1 on and Q2 off.
4. The purpose of sending the AR4 output to Q14 is
 - a. to disable the 135 Hz reference MVB during the time of the Burst.
 - b. sync the 135 Hz reference MVB to the 15 Hz reference MVB.
 - c. trigger the 15 Hz reference MVB during the time of the Burst.
 - d. to qualify the AND gate made up by CR15 and CR16.
5. Describe the operation and purpose of the Burst Eliminator.
6. Briefly describe the operation of the North Burst Detector.
7. What is the purpose of the BDM?
8. What is the purpose of Q5?
9. If the modulation of the 15 Hz signal drops below 5% of AR3 will be _____

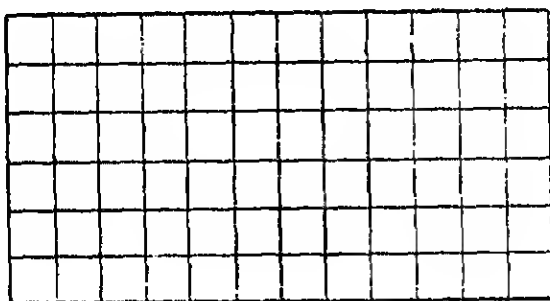


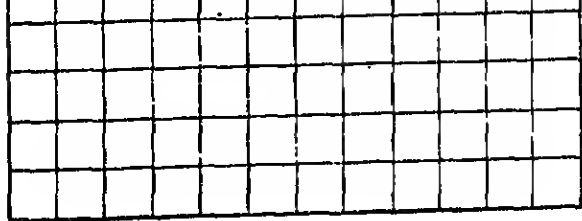
b. What is the purpose of the 15 Hz filter and phase inv

40° Gate Generator

a.

(1)





b. Describe each of the waveforms observed.

(1) _____

(2) _____

. 40° Coincidence

a.

(1) _____ vdc

(2) _____ vdc

b. What is the purpose of the 40° coincidence circuit?

. Search Control

a.

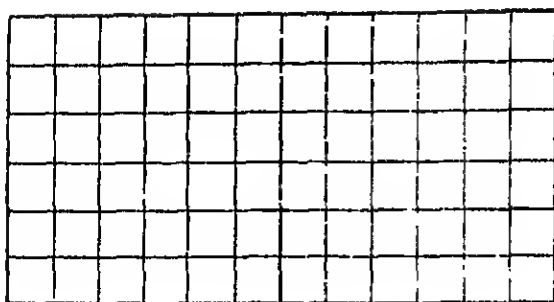
(1) Track _____ vdc

(2) Search _____ vdc

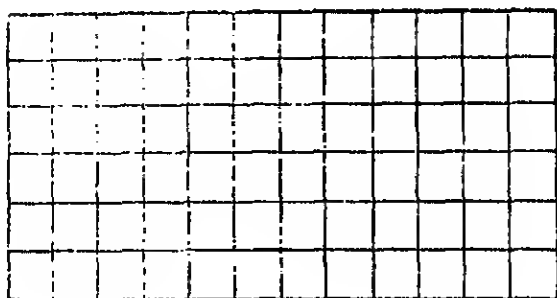
b. What is the purpose of the search control?

8.

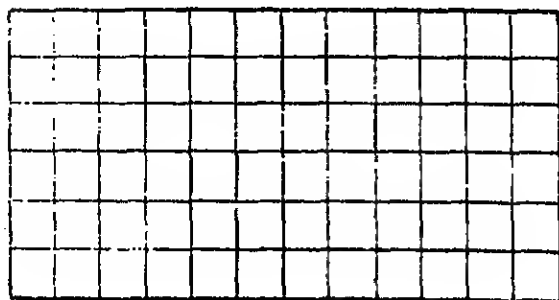
(1)



(2)



(3)

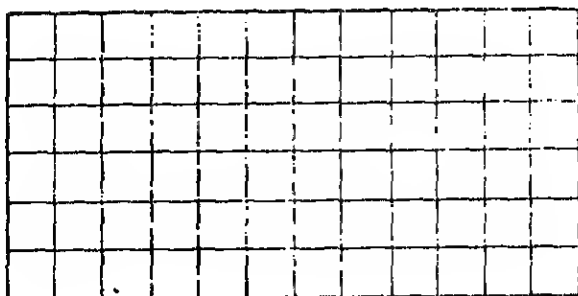


(1) Explain the use of the 15 Hz phase compara

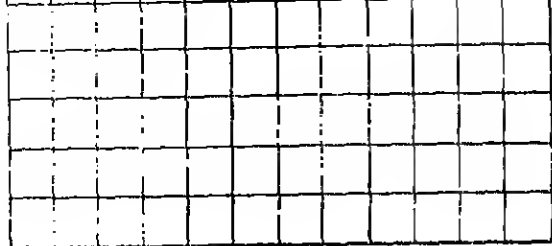
(2) Where will the 15 Hz comparator output be

7. 135 Hz Filter and Phase adjust

a.



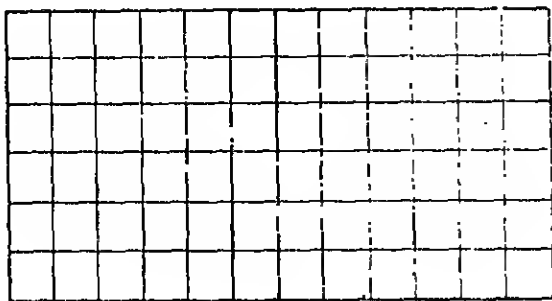
b. Where will the output be applied and what will



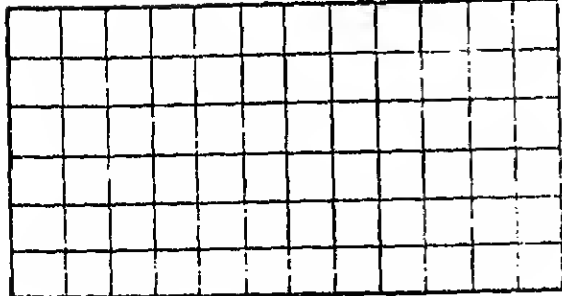
- b. Where and for what reason is the output of the 135 Hz Q5 applied?

135 Hz Summing Amplifier

- a.



- b. What is the purpose of applying the phase shifted 135 Hz to the reliability amplifier?
-
-



(4) _____ vdc

(5) _____ vdc

(6) _____ vdc

(7) _____ vdc

State the purpose of the 135 Hz comparators.

ING A AND B MODULE ANALYSIS

ne following questions:

fly explain the purpose of the BAM and BBM.

35 Hz resolver phase shifts the 135 Hz reference signal every _____ degrees of rotation of the bearing motor.

output from the 40° coincidence circuit in the BBM would

ference to the 135 Hz Phase Comparator, when C4 is more in respect to C3 the indicator will _____

fly explain why the indicator will turn at a maximum speed with no input to the search control circuits.

ere is a good signal present at both CR11 and CR12 in the BAM can will switch from _____ to _____.

basic circuit configuration of the MAG AMP drivers in the

search condition, the TACH feedback from the BMM to the _____ because K1 is _____.

signal seen at pin 8 of J1 in the BBM is _____
400 μ sec gate.

5 Hz square wave.

35 Hz square wave.

60 millisecond gate.

- . The discharge time of the memory capacitor, in the BBM _____ during 15 Hz track because K2 is _____
- . What is the purpose of 1A1A6 Q5? _____

- . The output of AR7 is sent to three different stages. _____ stages and the effect that AR7's output has on each.

- . When tracking a changing azimuth, the _____ out the BAM would be constantly _____
- . When the Tacan is locked on to a fixed bearing, the two _____ present at pin 4 of AR2 would be _____ degrees out of _____ and the two signals present at pin 4 of AR4 would be _____ degrees out of phase.
- . The output of AR13 in the BAM is a _____ Hz _____.
- . The signal present at 1A1A6 J1-4 is a _____ Hz _____.
- . In reference to the 135 Hz reliability, what is the purpose and CR6? _____

TITLE: TACAN TROUBLESHOOTING

Answer the following questions:

1. Tacan receiver sensitivity is weak. A possible cause is:
 - a. CR6 open.
 - b. Q6 open.
 - c. CR11 shorted.
 - d. AR7 inoperative.
2. Tacan Range, ID Tone and Bearing defective. A possible cause is (1A1A1)
 - a. Q10 shorted.
 - b. AR3 defective.
 - c. DL1 open.
 - d. AR8 inoperative.
3. Air-to-air operation is defective. A possible cause is:
 - a. R30 open.
 - b. R34 open.
 - c. P1-P open.
 - d. P1-R open.
4. No Tacan range. At J1-2, J1-4, waveforms appear normal. At J1-15 and J1-16 are abnormal. A possible cause is:
 - a. AR8 defective.
 - b. AR1 defective.
 - c. U1B defective.
 - d. Q3 open.
5. Tacan Range is inaccurate. A possible cause is:
 - a. R61 misadjusted.
 - b. R42 open.
 - c. Q1 shorted.
 - d. R15 misadjusted.
6. Tacan indicator slows down, but will not lock on. A possible cause is (1A1A2)
 - a. AR11 defective, no output.
 - b. U2C pin 8 open.
 - c. U1C pin 8 open.
 - d. U2D pin 11 open.

The Antenna Selector Module does not switch at the correct search condition. A possible cause is

- a. R29 shorted.
- b. R34 misadjusted.
- c. Q3 shorted.
- d. R4 misadjusted.

In the process of troubleshooting, it is noted that none of the relays are ever actuated. A possible cause is

- a. +120 volt supply.
- b. -15 volt supply.
- c. 1A1Q1 defective.
- d. 1A1A9 defective.

The -108 supply voltage is reading -130 volts. A possible cause is (1A1A15)

- a. CR815 open.
- b. Q812 open.
- c. CR824 open.
- d. R811 open.

(1A1A15) The 6.3 vac line is reading high. A possible cause is

- a. R833 open.
- b. R832 open.
- c. R829 open.
- d. R831 open.

Tacan range is bad. Signal at J1-7 is +13 vdc. Test point is normal. A possible trouble is (1A1A2)

- a. AR3 defective.
- b. U2A pin 2 open.
- c. U2C pin 8 open.
- d. C5 open.

Range flag on Tacan indicator remains up all the time. A possible cause is (1A1A3)

- a. Q17 open.
- b. Q18 shorted.
- c. K5 pin 6 open.
- d. K2 pin 3 open.

- c. K6 pin 7 shorted to ground.
- d. R37 open.

Tacan range indicator stops at the proper range, but remains in the window. A possible cause is (1A1A3)

- a. Q10 shorted.
- b. Q17 open.
- c. Q14 open.
- d. Q13 open.

No bearing, indicator searches counterclockwise. A possible cause is (1A1A4).

- a. R17 open.
- b. C18 open.
- c. CR7 open.
- d. CR16 open.

Indicator shows a 7° error. A possible cause is

- a. 1A1A5 R31 open.
- b. 1A1A6 R40 open.
- c. 1A1A6 R19 open.
- d. 1A1A4 R7 open.

Bearing indicator continuously searches. A possible cause is

- a. 1A1A4 CR15 open.
- b. 1A1A5 CR7 shorted.
- c. 1A1A5 C16 shorted.
- d. 1A1A6 AR8 bad.

Bearing indicator is 4° in error. A possible cause is

- a. 1A1A6 C15 shorted.
- b. 1A1A6 AR1 bad.
- c. 1A1A4 CR13 open.
- d. 1A1A5 AR13 bad.

Bearing indicator will not lock on. A possible trouble

- a. 1A1A4 Q14 open.
- b. 1A1A6 Q5 open.
- c. 1A1A5 Q2 open.
- d. 1A1A1 Q10 open.

MODULE ANALYSIS

the following questions:

Explain the purpose of the RF Module. _____

List the five sections of the RF Module.

_____ Series _____
_____ Series _____
_____ Series _____
_____ Series _____
_____ Series _____

List the sections of the RF Module that are mechanically tuned.

What is 1800 vdc applied to the RF amplifiers? _____

Explain the purpose of the preselectors _____

When will the frequency multipliers be disabled? _____

What reason is double conversion used in the IF's? _____

Explain the use of the deblocking circuit. _____

What is the purpose of the 1 μ sec delay in the modulator?

What is the purpose of the 1 μ sec delays in the modulator?

What does the A/A storage counter determine when it will trigger?

What are the four inputs to the base of Q1523 and where do they come from?

What is the purpose of the initial inhibiting circuit?

What is the purpose of the 25 μ sec suppression pulse at the trailing edge of the 170 μ sec pulse? What is this gate used for, and where is it developed?

How is the receiver blanked when transmitting?

Why is the A/A priority circuit used?

Answer the following questions:

1. Q4 will be triggered _____ μ sec after an input appears at the _____ edge of the _____ μ sec gate out of Q2.
2. When will CR8 be forward biased? _____

3. When will CR7 be forward biased? _____

4. Briefly explain the operation of the circuitry controlling the A/A mode of operation.

5. When Q3 is off, CR1 will be _____ and Q4 will _____

6. During the A/A mode of operation, which of the following are present?
 - a. K2, K3, K4, and K5 are all energized.
 - b. K2, K4, and K5 are energized, K3 is deenergized.
 - c. K4 and K5 energized, K2 and K3 are deenergized.
 - d. K2 deenergized, K3, K4, and K5 energized.
7. List the outputs of the AAM, where they go, and their functions.

8. What is the purpose of R13? _____

THE UNITED STATES NAVY

GUARDIAN OF OUR COUNTRY

The United States Navy is responsible for maintaining control of the sea and is a ready force on watch at home and overseas, capable of strong action to preserve the peace or of instant offensive action to win in war.

It is upon the maintenance of this control that our country's glorious future depends; the United States Navy exists to make it so.

WE SERVE WITH HONOR

Tradition, valor, and victory are the Navy's heritage from the past. These may be added dedication, discipline, and vigilance as the watchwords of the present and the future.

At home or on distant stations we serve with pride, confident in the respect of our country, our shipmates, and our families.

Our responsibilities sober us; our adversities strengthen us.

Service to God and Country is our special privilege. We serve with honor.

THE FUTURE OF THE NAVY

The Navy will always employ new weapons, new techniques, and greater power to protect and defend the United States on the sea, under the sea, and in the air.

Now and in the future, control of the sea gives the United States her greatest advantage for the maintenance of peace and for victory in war.

Mobility, surprise, dispersal, and offensive power are the keynotes of the new Navy. The roots of the Navy lie in a strong belief in the future, in continued dedication to our tasks, and in reflection on our heritage from the past.

Never have our opportunities and our responsibilities been greater.